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# Narrative and epistemology: Georges Canguilhem's concept of scientific ideology

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## Abstract

In the late 1960s, Georges Canguilhem introduced the concept of 'scientific ideology'. This concept had not played any role in his previous work, so why introduce it at all? This is the central question of my paper. Although it may seem a rather modest question, its answer in fact uncovers hidden tensions in the tradition of historical epistemology, in particular between its normative and descriptive aspects. The term ideology suggests the influence of Althusser's and Foucault's philosophies. However, I show the differences between Canguilhem's concept of scientific ideology and Althusser's and Foucault's respective concepts of ideology. I argue that Canguilhem was in fact attempting to solve long-standing problems in the tradition of historical epistemology, rather than following the lead of his younger colleagues. I argue that Canguilhem's 'refurbishment without rejection' of Bachelard's epistemology, which the concept of scientific ideology was aimed to implement, was necessary to justify the historical narratives that Canguilhem had constructed in his own work as a historian of concepts. A strict acceptance of Bachelard's epistemology would have made it impossible to justify them. Canguilhem's concept of scientific ideology therefore served as a theoretical justification of his practice as a historian. I maintain that the concept of scientific ideology was needed to reconcile Bachelard's normative epistemology with Canguilhem's view of the history of science and its aims, which differed from Bachelard's more than it is generally acknowledged.

## 1. Introduction

In the late 1960s Georges Canguilhem introduced the concept of 'scientific ideology', at a time when he had already published his two major books, *La formation du concept de réflexe aux XVII<sup>e</sup> et XVIII<sup>e</sup> siècles* (1955) and *The Normal and the Pathological (Le normal et le pathologique*, 1966, first part [1943]). Before his seminal article 'What is scientific ideology?', eventually published in *Ideology and Rationality*,<sup>1</sup> this concept had not played any role in his work, so why introduce it at all? This is the central question of my paper. Although it may seem a rather modest question, its answer in fact

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<sup>1</sup> He gave a paper entitled 'Qu'est-ce qu'une idéologie scientifique?' in 1969, published the following year in the journal *Organon*, and eventually in (Canguilhem 1993 [1977]), English translation in (Canguilhem 1988 [1977]).

uncovers epistemological and historiographical complexities and hidden tensions in the tradition of historical epistemology.

It is tempting to see Canguilhem's introduction of the concept of scientific ideology simply as a response to the philosophical and political agendas of the Sixties. In fact, in the Preface of *Ideology and Rationality*, written in 1977, Canguilhem told his readers that he had introduced the concept of scientific ideology in his lectures under the influence of Louis Althusser and Michel Foucault. Humble as always,<sup>2</sup> he paid homage to the younger academics and rising stars who were critically continuing the tradition of historical epistemology that Canguilhem and Bachelard had established. More than two decades later, again he responded in the affirmative to François Bing and Jean-François Braunstein's question about whether his use of the concept of ideology was inspired by Althusser. Unfortunately, he did not elaborate on the extent or detail of this inspiration (Bing and Braunstein 1998, 128). There is no doubt that the context of Canguilhem's introduction of this new concept is important. However, it would be far too hasty to think that his younger colleagues had caused a significant change in his epistemology. Claude Debru has argued that with his article on ideology Canguilhem in fact intended to remind Foucault and Althusser of what they owed to epistemology and to the distinction between science and non-science (Debru 2004, pp. 79-80). Indeed, already in the third paragraph of his short Preface of *Ideology and Rationality*, Canguilhem declared that his ideas had not changed. In the same volume, he rejected the Althusserian interpretation that Dominique Lecourt had made of Bachelard's philosophy, even suggesting that what the Althusserians called science had in fact nothing to do with science, but rather only with politics. He also distanced himself from Foucault's turn in history of science (Canguilhem 1993 [1977], pp. 27-8). Moreover, an immediate issue is that Canguilhem wrote about 'scientific ideology', which for Althusser would have been no more than an oxymoron. Canguilhem did not even mention Althusser or Foucault in his paper on scientific ideology.<sup>3</sup> His only substantial reference to a previous concept of ideology is to Marx's. Despite introducing a new concept into his philosophy, Canguilhem appeared to look back rather than forward: he explained that the introduction of the concept of scientific ideology was a way of 'refurbishing without rejecting the lessons of... Gaston Bachelard' (Canguilhem 1988 [1977], p. ix);(Canguilhem 1993 [1977], p. 9). So the question remains: why was this revision called for? And how was the concept of scientific ideology going to help?

Canguilhem presented the concept of scientific ideology in relation to a historiographical issue, that of the object of the history of science. I shall follow him and examine his concept from a

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<sup>2</sup> Canguilhem was certainly more of a 'mandarin' than a public intellectual. A strong testimonial of Canguilhem's lack of ambition to stardom is Pierre Bourdieu's (Bourdieu 1998).

<sup>3</sup> Although he does so in the Preface of the volume in which the article appears, as mentioned.

historiographical point of view. I shall argue that his ‘refurbishment without rejection’ of Bachelard’s ideas was in fact more profound than it may appear, and it was also necessary because of a tension between the normative and descriptive characters of historical epistemology. I shall show that Canguilhem introduced the concept of scientific ideology as a solution, or an attempted solution, to a historiographical problem: that a straightforward application of Bachelard’s normative view of science would have made it very difficult to construct narratives in history of science, in particular those narratives that Canguilhem had constructed in his practice as a historian of concepts.<sup>4</sup> This is not only a historiographical problem, but also an epistemological one, as I shall show. I shall start by presenting the problem. I shall then sketch Canguilhem’s concept of scientific ideology, and evaluate it against the background of related concepts elaborated by Bachelard, Althusser and Foucault. In this series of brief comparisons, it will emerge that aspects of Canguilhem’s view of science and its history are conceptually more closely linked to Léon Brunschvicg’s than later developments of historical epistemology and its legacy. Canguilhem’s introduction of the concept of scientific ideology also contributes to show that his view of the aims and shape of the history of science departed from Bachelard’s more than is generally acknowledged.

## **2. The problem: narrative and epistemological break**

The problem at the core of Canguilhem’s paper on ideology is at the same time historiographical and epistemological. It is historiographical because it concerns the object of the history of science: Canguilhem discussed what history of science should be history *of* (Canguilhem 1993 [1970], p. 33). It is also an epistemological problem, as it entails determining which body of beliefs and practices counts as science and which does not. The normative and the descriptive approaches cannot be easily disentangled. Canguilhem argued that epistemology has always been historical, as epistemologists cannot but refer to the history of science for their models of scientific knowledge. As Léon Brunschvicg and Gaston Bachelard before him, Canguilhem thought that the previous epistemologists’ mistake had been to believe that science had reached its definitive form with Newton. This was Kant’s ‘error’, which Canguilhem ascribed to the ‘culture of the period’, that is the Enlightenment: it was difficult at

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<sup>4</sup> The relationship between history and philosophy of science is a very complex and long-standing problem. The tradition discussed here was one of the attempts at the integration of history and philosophy of science; this question has returned on many occasions, notably with Thomas Kuhn in Anglophone philosophy, and more recently with the ‘integrated HPS’ project (see Schickore 2011). I will not discuss this general issue, but the present article may nevertheless indirectly contribute to it.

that time to 'envison the possibility of a history of categories of thought' (Canguilhem 1988 [1977], p. 11). The project of historicisation of Kantian philosophy, which had been extensively pursued by Brunschvicg, had been fully absorbed in the tradition of historical epistemology by the time Canguilhem wrote his works. Brunschvicg argued that Albert Einstein had shown that the Kantian intuitions of space and time are not the only 'containers' of human experiences (Brunschvicg 1922); (Brunschvicg 1920); (Brunschvicg in (Einstein 1922)). Similarly Bachelard had interpreted Einstein's theory of relativity as the emergence of the 'new scientific mind' (Bachelard 1993 [1938], p. 7); (Bachelard 2002 [1938], p. 19).

If our categories of thought change, then epistemology must be revised in accordance with the advancement of science. In other words, epistemology for both Canguilhem and Bachelard should be truly historical. Epistemology should follow the history of science because it is current science that dictates what knowledge is. This is precisely what Bachelard thought: for him, current science is the norm of truth and scientificity. In his words: 'the major lesson that the philosopher should learn from the evolution of science is that philosophy itself should be altered' (Bachelard 1972 [1953], p. 135). Canguilhem often referred to Bachelard's conception of scientific truth, and did so also in *Ideology and Rationality*, where he favourably quoted Bachelard saying that 'truth is simply what science speaks' (Canguilhem 1988 [1977], p. 11). Just as for Bachelard, for Canguilhem, science, which is 'a project aimed at the truth', dictates what is true and what is false. Truth, as a consequence, is the same as scientific truth, and knowledge the same as scientific knowledge. He argued that 'scientific knowledge' is a pleonasm, just as 'true knowledge' is (Canguilhem 2015 [1965], pp. 1206, 1203).

Canguilhem accepted Bachelard's normative approach to the history of science: for him past theories and practices should be evaluated from the point of view of current science. However, the issue of the links between the present and the past of science is complex; as I shall argue that Bachelard and Canguilhem offered partially different solutions to it.

Bachelard regarded the history of science as characterised by 'epistemological breaks', that is re-organizations of knowledge, as the above-mentioned revolution in physics that the theory of relativity brought about. For him, science advances by 'saying no' to previous doctrines and practices. However, this does not mean that science rejects its past to start anew; in fact science produces what can be called a dialectical synthesis of its past and the negation of its past in order to create something new that maintains a relation with its past. The past is re-interpreted in order to be assimilated by current doctrines; if this re-interpretation did not take place, no synthesis would be possible. This re-interpretation is a 'rectification' and 'rationalisation' of past doctrines. (Bachelard 1988 [1940]); (Bachelard 1991 [1934], Ch. 2); (Bachelard 1987 [1927], Ch. 2). Bachelard contended that the first notions that human beings form about nature are the results of their imagination and drives, and

employed his psychoanalysis of objective knowledge to uncover them (Bachelard 1993 [1938]). For him the imaginative approach to nature is spontaneous and hard to change; indeed, until the end of the eighteenth century it dominated the study of nature to such a degree that science could not emerge. Only between the end of the eighteenth century and the beginning of the nineteenth did the mind start to overcome the obstacles posed by emotions and the imagination. As a result, a rational approach to the study of nature, that is science, began (Bachelard 1993 [1938], p. 7). Science, in order to advance in its dialectical history of increased rationality, needs constantly to overcome the epistemological obstacles that our very nature puts in its way. Scientists must 'purify' their objects from the emotions that they have projected onto them. At the same time, they must 'rectify' their own minds, and purify them from the dreams and emotions that create obstacles to scientific knowledge (Bachelard 1993 [1938], p. 71); (Bachelard 1986 [1949]).

Scientists rectify the past of their particular disciplines just as they rectify their objects. The history of science that scientists produce, then, is a rationalized history, a history re-written from the point of view of the present. Bachelard called this rationalized history 'sanctioned history' (*histoire sanctionnée*) as opposed to 'lapsed history' (*histoire périmée*). For him, sanctioned history is a recurrent history, which is constantly revised. We have then two types of history with two different objects. However, Bachelard in reality denied any real narrative to lapsed history. Since for him emotions and drives that influence 'false' doctrines are constant in the human mind, the various lapsed doctrines would always be the result of the same attitudes. For Bachelard, historians of science who wish to work on lapsed history should be aware that their work is a 'palaeontology' of a mentality that no longer exists (Bachelard 1951, p. 25). This is of course in stark contrast with the strongly progressive, though discontinuous, narrative of sanctioned history. Bachelard's view of history of science, which Canguilhem overtly embraced (e. g. (Canguilhem 1994 [1968], p. 13)) seems to leave little space for narratives that are not those 'sanctioned' by current science and that link present science with lapsed doctrines. It also interdicts long narratives, as science for Bachelard has only begun at the end of the eighteenth century.

### **3. Narratives across epistemological breaks**

In *La formation du concept de réflexe aux XVII<sup>e</sup> et XVIII<sup>e</sup> siècles* Canguilhem targeted the continuity that a certain Whiggish history had created between the current concept of reflex and Descartes' concept of involuntary movement.<sup>5</sup> For Canguilhem, his own normative method revealed this

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<sup>5</sup> Canguilhem did not use the term 'Whiggish', and it should not be assumed that his target was Whiggish history. See on this point Bowker and Latour's interesting take on Canguilhem vis-à-vis Whiggish history: (Bowker and Latour 1987, pp. 724ff.).

continuity to be false, and to be just a projection of our present concept onto a past concept that in fact had no relation with it. An analysis of the two concepts – the current one and Descartes' – for him shows that they are heterogeneous, and that Descartes' concept does not belong to current science or its past. Descartes presented the human body as a machine, and explained its movements mechanically. According to him, the blood, brought to the heart through the veins, gets heated in the heart, and then sent to all parts of the body. The 'most agitated and most active' parts of this blood, which contain 'animal spirits', go straight to the brain. From the brain the animal spirits flow 'through the nerves into all the muscles, thereby making these nerves serve as organs of the external senses and inflate the muscles in various ways imparting movement to all bodily parts' (Descartes 1998 [1647-8], p. 172). The nerves from the brain extend to all parts of the body. When the nerves are moved by an object of sense in any part of the body, they also get 'pulled', and as a result they open the 'entrances of certain pores in the internal surface of the brain' (Descartes 1998 [1632-3], pp. 116-7). The animal spirits are then free to flow from the brain towards the part of the body where the nerve has been pulled. In Descartes' presentation, the 'animal spirits' always flow from the brain, and never in the opposite direction. Canguilhem emphasised that the two actions – the pulling of the nerve in the periphery, and the flowing of animal spirits from the centre – are completely heterogeneous (Canguilhem 1977 [1955], p. 35). In other words, there can be no 'reflection' of movement.

Canguilhem employed Bachelard's normative approach to the history of science in order to show that the alleged continuity between Descartes' and the current concept is untenable. This part of his argument follows Bachelard's historiography, and indeed may remind the reader of Bachelard's discussion of eighteenth-century natural history and alchemy, as he similarly aimed to show their discontinuity with chemistry. However, Canguilhem not only showed the epistemological break that a Whiggish narrative may paper over, but he also constructed an alternative narrative that contains a surprising continuity: that between the current concept of reflex and the concept of reflex elaborated by the seventeenth-century natural historian and medic Thomas Willis. Unlike Descartes, Willis regarded the movements of the 'animal spirits' along the nerves as flowing both from the brain to the periphery and vice versa. For him, the flux of animal spirits can be inverted by reflection; in order to illustrate this movement he employed the images of reflected light, of waves on the water surface, and of sound and echo (Canguilhem 1977 [1955], p. 66). Unlike Descartes, Willis regarded the movement from the centre to the periphery and that from the periphery to the centre as homologous. This view for Canguilhem is necessary in order to elaborate the concept of reflex (Canguilhem 1977 [1955], p. 41). For this reason, he regarded Willis's concept of reflex as a stepping stone in the history of the current concept.

For all his overtly adherence to Bachelard's epistemology, Canguilhem constructed a rather non-Bachelardian continuous history of the concept of reflex movement. As mentioned, for Bachelard no seventeenth-century natural philosophy qualified as science. More importantly, for him concepts are not independent of the theories in which they are used, or indeed of the minds that created them. Bachelard rooted the break between alchemy and chemistry in the respective 'mentalities' that produced them: he studied the mind in its history. For him alchemy was a product of the imagination, whereas current chemistry is the product of rationality. When Bachelard analysed particular concepts he treated them as examples of a general attitude. By Canguilhem's own admission, Willis's theory of life as light was rather imaginative. For Bachelard, imagination cannot produce science, but only obstacles in its path that reason has to overcome. Similarly, a concept for him cannot have a life independently of the specific mental categories and experimental apparatus that produce it. By contrast, in order to show the break between Descartes' concept of reflex movement and the current one, Canguilhem only analysed the concepts, relatively independently from the theories of which they are part, not to mention from categories of thought. Indeed, one of his main aims in *La formation du concept de réflexe* was to show that scientific concepts can have a relatively independent history.<sup>6</sup> For him the 'prejudice' that only mechanistic theories have produced positive results in biology led historians to overlook concepts, such as Willis' concept of reflex, because they belonged to other types of theories. His focus on concepts enabled him to construct a link between Willis's concept and modern science, despite the vastly different contexts.

Canguilhem was of course aware that he was constructing a continuity that was not easy to justify from the point of view of Bachelard's historiography and epistemology. He justified his difference with Bachelard by invoking two factors. The first, which Canguilhem received from Bachelard, is that young sciences exhibit stronger continuities than mature sciences.<sup>7</sup> The second reason is that the life sciences, which are the focus of his work, do not exhibit the breaks that one can observe in physics (Canguilhem 1994 [1966], p. 14). There are, however, some problems with these reasons. First, are young sciences more continuous than mature ones? This is entirely reasonable, but whether a discipline is 'young' or 'mature' depends, at least in part, on when we set the birth of said discipline, and this is an issue on which historians and philosophers of science may well disagree. There is no doubt that Bachelard held a radical view, setting as he did the emergence of the 'scientific mind' at the end of the eighteenth-century. Chemistry for him exhibits an epistemological break with alchemy and allied disciplines; as a consequence, the activities and theories of natural philosophers up to the end of the eighteenth-century are not part of the history of chemistry. Medicine, as presented by Canguilhem,

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<sup>6</sup> Regarding the independence of concepts from theories in Canguilhem, see (Macherey 2009, pp. 46ff.)

<sup>7</sup> Commentators have also mentioned this reason, see for instance (Dagognet 1997, p. 163).



appears to be far older than Bachelard's chemistry. Are the life sciences and medicine more continuist than chemistry and physics? It seems to me that Canguilhem's sometime more continuist view of history of science than Bachelard's does not so much depend on the sciences he studied, but rather on his own evaluation of them. Even when discussing physics, Canguilhem was more inclined to see continuities alongside discontinuities, as for instance when he lauded Ludovico Geymonat for stressing the (still) Aristotelian aspects of Galileo's approach to the study of nature, against the more discontinuist reading of Alexandre Koyré (Canguilhem 1993 [1977], p. 25).

Canguilhem's claim that a break does not occur in all sciences in the same way or at the same time is completely in accordance with Bachelard's philosophy, which envisages 'regional rationalisms' (Bachelard 1986 [1949], Ch. 4). However, it is much less Bachelardian to say that a break can be 'only' detected with hindsight, as Canguilhem did for instance with regard to eighteenth-century natural philosophy, which in his evaluation did not seem lapsed until the early post-Darwinian years. He argued that an epistemological break was only visible 'as a result of a subsequent cataclysm: the rise of genetics and molecular biology' (Canguilhem 1993 [1977], 26). For Bachelard, what is science and what is not, and what is rational and what is not, is established from the point of view of current science. So, it is a matter of course that breaks are seen as such with hindsight. By contrast, Canguilhem wanted to place himself at a particular moment in history (e.g. early post-Darwinian years) and judge eighteenth-century natural history from there. He also suggested that all those theories, before and after any 'cataclysm', are still part of the history of science. It is apparent that Canguilhem did not aim to construct a 'rectified' history of science. He admitted that his own work on the history of medicine could be seen as a 'palaeontology' of lapsed mentalities [*esprit*] from a Bachelardian point of view.<sup>8</sup> On this point, Camille Limoges has warned that *La formation du concept de réflexe*, despite being dedicated to Bachelard, and carrying a similar title as Bachelard's *La formation de l'esprit scientifique*, is not an application of the epistemology presented in the latter (Limoges 2015, p. 41). There is a problematic tension between Bachelard's philosophy, which he overtly accepted, and his practice as a historian of science. In other words, Bachelard's epistemology created problems for Canguilhem as a constructor of narratives. I aim to show that the latter's concept of scientific ideology was aimed to solve this problem.

#### **4. The concept of scientific ideology**

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<sup>8</sup> (Canguilhem 1987), also quoted in (Limoges 2015, p. 41). Here Canguilhem refers to Bachelard's view of the history of 'lapsed' theories and mentalities as 'palaeontology', discussed above.

Canguilhem's scientific ideology is not science, but belongs to its history; it is not science but is not opposed to it, nor is it an epistemological obstacle. What is it, then? First of all, it comes in two embodiments: in the first, it precedes science, and in the other is parasitic on it. The first type of ideology comprises the systems of ideas that occupy the same domain as science will later do, but that are not fully scientific in methodological and operational terms. As examples of this type of ideology, Canguilhem cited Democritus's and Lucretius's atomistic theories. The other type of scientific ideology is parasitic on science, as it extends scientific theories to fields that are not of their competence. An example of this type of ideology is Herbert Spencer's theory of evolution. Spencer extended the field of application of laws that belonged to embryology and biology to the totality of human experience. Canguilhem remarked that Spencer even 'claimed to have deduced the phenomenon of evolution from the law of conservation of energy, which he maintained could be used to prove that homogeneous states are unstable' (Canguilhem 1988 [1970], p. 36). The relationship of Spencer's theory to science is clear, but in fact it has a crucial flaw: genuine scientific laws are arbitrarily applied to new domains, on which they have no validity.

As far as the concept of ideology is concerned, Canguilhem's only reference in 'What is scientific ideology?' is to Karl Marx, if we exclude a one-paragraph history of the term since the Enlightenment (Canguilhem 1993 [1970], pp. 35-6); (Canguilhem 1988 [1970], pp. 29-30). Indeed, his main source for Marx's concept of ideology is *The German Ideology*; this avoids any complication arising from the evolution and variations in Marx's concept of ideology.<sup>9</sup> To be fair, though, Canguilhem did not aim at an exegesis of the Marxian concept of ideology, but rather at the elucidation of his own concept. His reference to Marx gives Canguilhem the opportunity to discuss what presumably was in the minds of his readers, namely that the concept of scientific ideology is a 'contradiction in terms', indeed a 'logic monster' (Canguilhem 1988 [1970], p. 36). For those who, in those years, had attended Althusser's lectures, 'ideology' and 'scientific' just did not go together. Canguilhem explained that for Marx ideology 'fails to touch the true object that it believes it is examining' and that 'no ideology speaks the truth' (Canguilhem 1988 [1970], p. 30). By contrast, his scientific ideology is not 'false consciousness' as in the case of political ideology. He pointed out that Marx had criticised Feuerbach because the latter had failed to realise that so-called pure science 'takes its aims and its means from commerce and industry, or, in other words, from the man's material activity'.<sup>10</sup> Canguilhem argued that the sciences can and do develop as the result of specific historical and technical circumstances, or out of particular interests, but this does not mean that their methods are not autonomous, that is that they

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<sup>9</sup> For a view of the evolution of the concept of ideology in Marx's thought see (Larrain 1979, pp. 37ff.).

<sup>10</sup> (Canguilhem 1988 [1970], p. 31). Canguilhem does not mention the classic Marxist article precisely on this topic, Boris Hessen's 1931 paper on Newton (Hessen 1931), which was translated into French for the first time only in 2006 (Lamy 2010).

are ideologies in the Marxian sense. He rhetorically asked how Marxism could 'refuse to Greek geometry' the autonomy that Marx had 'granted to Greek art' (Canguilhem 1988 [1970], p. 30). Like Bachelard, Canguilhem merged the descriptive and normative meanings of science, for he accepted Bachelard's view that truth is what science speaks. Therefore for Canguilhem, the sciences, as speakers of the truth, are epistemologically independent of their contingent historical and social circumstances, even if, as historical products, they may be the results of social interests. This is why a theory such as Newton's celestial mechanics can find experimental confirmations in the twentieth century, in very different economic and technical circumstances from those in which it emerged (Canguilhem 1988 [1970], p. 37). Canguilhem's scientific ideology is neither simply the recognition that the sciences may owe their development to social interests, nor does it imply that it is opposed to science. It is therefore different not only from Marx's ideology, but also from Althusser's. Most importantly here, it contradicts Bachelard, for whom no body of beliefs could occupy an epistemological space between science on the one hand and the works of the imagination on the other.

## **5. Scientific ideology, science and non-science**

In order to grasp Canguilhem's concept of ideology, it is useful to analyse it in relation to similar concepts put forward by Canguilhem's most direct interlocutors, and to focus one's attention on either type of ideology in turn. The type of scientific ideology that precedes science arguably best illustrates Canguilhem's departures from Bachelard's view of history of science. As mentioned, Canguilhem employed Democritus's and Lucretius's atomic theories as examples of this type of scientific ideology. For him, these theories were not properly scientific, and their domain has since been occupied by fully scientific theories. Ancient atomism for Canguilhem nevertheless belongs to science and its history because it stood in opposition to religion, superstition and 'false science'. He wrote that '[t]o the antisience of religion they [Democritus and Lucretius] opposed the antireligion of science' (Canguilhem 1988 [1970], p. 33). Ancient atomism, like the other scientific ideologies that precede science, fell short of being fully rational and scientific because it lacked the 'methodological requirements and operational possibilities' of science (Canguilhem 1988 [1970], p. 33). What makes it part of the history of science is precisely its rational approach and critical attitude towards received notions. Canguilhem emphasised that scientific ideology is not anti-science; it is rather on the side of science and against anti-science.<sup>11</sup> Indeed, he pointed out that superseded notions, attitudes and

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<sup>11</sup> In 'What is scientific ideology?' Canguilhem referred in particular the concept of anti-science that Bogdan Suchodolski had presented in his paper at the 12<sup>th</sup> International Congress of History of Science in 1968 (Suchodolski 1970). This reference arguably tells us more about Canguilhem's manners than his argument, for

methods had in their time superseded previous notions, attitudes and methods (Canguilhem 1994 [1966]). A critical attitude for Canguilhem is a scientific one, and therefore past notions and methods, even if they do not adhere to current norms of scientificity, for him are still part of the history of science. In his view, what Lucretius and Democritus achieved was not fully science yet, but nevertheless was a stepping stone towards the fully rational and secular approach of modern science. While defending normativity in the history of science, Canguilhem claimed that the judgements of epistemology do not translate into purges or executions of theories that do not live up to the norm of current science (Canguilhem 1994 [1968], p. 14). For him, there is room in the history of science for those theories and practices that are not science by current standards, but still exhibit the critical attitude of science.

Canguilhem's outlook here is consistent with the intellectual tradition that stretches back to the Enlightenment, and is directly linked to Léon Brunschvicg's philosophy. In fact, Canguilhem's discussion of scientific ideology recalls Brunschvicg's view of history of science and philosophy as a progressive, if tortuous, advancement of rationality and secularism over superstition and faith. In the specific case, Brunschvicg regarded Democritus's atomism as the beginning of the investigation of nature by reason alone rather than revelation or tradition (Brunschvicg 1947, p. 52). For him it was one of the theories that stood as a 'prelude' to science; on the one hand, it was the work of genius, on the other hand, it did not have a proper relation to reality because of its complete lack of experimental tools (Brunschvicg 1922, p. 125). By contrast, Bachelard had a rather different view of ancient atomism, interested as he was in pointing out the novelty of modern science rather than the progress of the history of thought. The conception of the atom as the smallest and indivisible component of matter is for him an intuition that is shared by Democritus and the twentieth-century philosopher who vainly attempts to understand modern physics. For him this intuition belongs to 'common knowledge' [*connaissance commune*], and, like all 'common knowledge', is an epistemological obstacle that the scientific mind must overcome (Bachelard 1951, p. 75).<sup>12</sup> For Bachelard, it goes without saying that ancient atomism had no influence on modern atomism; in fact it had none even on early modern thinkers such as Gassendi or Boyle (Bachelard 1933, p. 10). In his early book *Les intuitions atomistiques*, written before elaborating the concepts of epistemological obstacle and epistemological break, Bachelard already sanctioned the 'illusory character' of 'our first

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his own paper was first delivered in Warsaw, at the invitation of the Polish Academy of Sciences, of which Suchodolski was an eminent member.

<sup>12</sup> Bachelard had specific epistemological reason for distrusting '*connaissance commune*' and for regarding it as separated from scientific knowledge by an epistemological break; see for instance (Bachelard 1986 [1949], Ch. 4) and (Bachelard 1972 [1953], Conclusion). However, the negative connotations of '*connaissance commune*' were mainstream in France. A popular textbook taught pupils that scientific knowledge and common knowledge differ as for 'standpoints, methods and values' (Dugas 1915, p. 1). Bachelard fully subscribed to this view.

intuitions' (Bachelard 1933, p. 153). Moreover, his treatment of 'atomistic intuitions' is not chronological, but rather thematic (realist atomism, positivist atomism, criticist atomism, and axiomatic atomism), already denying a narrative to non-scientific theories. For Bachelard, only science exhibits a history, and ancient atomism for him cannot be really understood in historical terms, nor can it be part of the narrative of science.

Canguilhem's presentation of the type of scientific ideology that is parasitic on science suggests a different set of issues and comparisons. He suggested that the parasitic type is closer to the Marxian concept of ideology. Evolutionist ideology, as in Spencer's theories, for Canguilhem functions as a justification of a certain type of society against traditional society and religion on the one hand and the demands of the workers [*la revendication sociale*] and socialism on the other (Canguilhem 1988 [1970], p. 37); (Canguilhem 1993 [1970], p. 43). This type of ideology serves practical ends, whereas Canguilhem did not suggest that this is the main function of pre-science ideology. Although he only referred to Marx, some parallels can be drawn between post-science scientific ideology and Althusser's ideology, in that the latter, as the imaginary form of the real relation of human beings and the world, has a practical function rather than a theoretical one. However, Canguilhem's scientific ideology and science are not separated by an epistemological break, in fact they share the same critical approach to reality. The real discontinuity is between scientific ideology and science on the one side and superstition and religion on the other. This is why Canguilhem could construct the type of historical narratives that he did for instance regarding the concept of reflex.

By contrast, Althusser's ideology and science are separated by an epistemological break. In this regard, Althusser's concept of ideology is in fact closer in its form – if not in its content - to Bachelard's works of the imagination (pre-science, poetry, reverie) than to Canguilhem's scientific ideology. Indeed, Althusser presented the 'opposition that separates science from ideology' on the model of Bachelard's epistemological break (Althusser 1969 [1965], p. 13).<sup>13</sup> Whereas Canguilhem's science and scientific ideology share critical attitude and aims, Bachelard's works of the imagination and science, just as Althusser's ideology and science, have different objects, different aims and different methods. As Martin Kusch has put it, for Althusser the 'prehistory of science is always an "ideological theoretical practice" which is "qualitatively" distinct from, and discontinuous with, its history' (Kusch 1991, p. 37). Canguilhem's scientific ideology sits between science and non-science, but it is not equidistant from them. Scientific ideology has already broken with superstition and religion, and shares its critical

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<sup>13</sup> In *For Marx*, his 'Letter to the translator' is of great interest. He once again acknowledged his debt to Bachelard for the concept of break, and remarked that Canguilhem's use differed from his own; however he added that his debt to Canguilhem was 'incalculable', and that his own interpretation of the break was a 'continuation' of Canguilhem's, in fact it was 'going beyond the point where his has (for the time being) stopped' (Althusser 1969 [1965], p. 257).

approach with science. As a consequence, there is no transition between anti-science and scientific ideology, but rather an opposition. On the other hand, there can be a historical continuity between scientific ideology and science. Once science emerges, it replaces scientific ideology. On the contrary, Althusser's ideology, which is heterogeneous with science, can never be eliminated. Even in the classless society, ideology for him will play a role. This is because people have to make sense of their lives, and need a system of ideas to guide them in their practical aspirations and actions (Althusser 1969 [1965], pp. 231ff.). Althusser's view of the different roles that science and ideology play may be seen as an anti-humanistic version of Bachelard's view. For Bachelard the rational approach of science would never, and should never, eliminate the imaginative approach from people's lives. The imagination certainly creates epistemological obstacles that science must overcome in order to advance. However, the imagination also creates poetry and dreams that for Bachelard should always be part of human life. Indeed, he proposed a 'double anthropology' of the 'diurnal man' (engaged in the rational work of science) and the 'nocturnal man' (engaged in reverie and poetry); these two 'men' are two sides of an individual (Bachelard 1972 [1953], p. 19); (Bachelard 1971 [1960], pp. 53-4, 212). Unlike the works of rationality, for Bachelard the works of the imagination do not have a history. For him, the desires and drives that produce pre-science as well as dreams are understood in psychoanalytical terms. Similarly, Althusser did not regard ideology as historical, indeed he called it 'eternal', referring the term to Freud. He wrote that 'ideology is eternal, exactly like the unconscious' (Althusser and Brewster 1971, p. 161), and as a consequence, just as Marx's in the *German Ideology*, it has no history (Althusser 1969 [1965], p. 232).<sup>14</sup> By contrast, Canguilhem's scientific ideology has a history (Canguilhem 1993 [1970], p. 39); (Canguilhem 1988 [1970], p. 33), indeed it is part of the history of science. For Canguilhem the history of science is the 'history of an axiological activity: the search for truth' (Canguilhem 1994 [1968], p. 19), and all genuine attempts to get to the truth should be part of it.

## **6. Scientific ideology, normativity and error**

With the introduction of the concept of scientific ideology, Canguilhem softened Bachelard's rupture between science and non-science. This does not mean that he abandoned the normative approach to the history of science. His history of science is still an epistemological history, in which truth and error

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<sup>14</sup> Althusser referred to *The German Ideology* when presenting his thesis that ideology has no history. He shared Marx's view on this, although he added that his own thesis 'is radically different from the positivist and historicist thesis of *The German Ideology*' (Althusser and Brewster 1971, p. 151). A detailed explanation of his own thesis follows.

are dictated by science and reason. Indeed, he criticised Thomas Kuhn's concept of paradigm, because, in presenting a paradigm as a choice of its users, Kuhn in his view relocated a philosophical problem to the domain of social psychology (Canguilhem 1993 [1977], p. 23). As Claude Debru has emphasised, for Canguilhem 'the norms of the scientific discourse are not – or not only, or not essentially – social norms' (Debru 2004, p. 83).

Canguilhem's epistemological approach distinguishes his view of history of science and his concept of ideology from Foucault's. It is well known that Foucault presented his own archaeology of knowledge as an advancement over Bachelard and Canguilhem's 'epistemological history of the sciences'. He placed his archaeology in their philosophical tradition,<sup>15</sup> but presented it as an analysis at a deeper level and as aimed at 'uncovering discursive practices in so far as they give rise to a corpus of knowledge, in so far as they assume the status and role of a science' (Foucault 1972 [1969], p. 190). Unlike Canguilhem's, his archaeological history does not have 'scientificity as a norm' (*Ibid.*).<sup>16</sup> Foucault's novel aim is reflected on his concept of ideology. He summarised his view in four points, which can be read as targeted criticism of his intellectual fathers. Three of them are of particular interest here. The first is that ideology does not exclude scientificity. In his own words, '[f]ew discourses have given so much place to ideology as clinical discourse or that of political economy: this is not a sufficiently good reason to treat the totality of their statements as being undermined by error, contradiction, and lack of objectivity' (Foucault 1972 [1969], p. 186). This arguably needed to be said to differentiate his view from Bachelard and Althusser's. Interestingly, Foucault here is closer to Canguilhem, as the latter, with his concept of 'scientific ideology', envisaged a body of knowledge that is ideological but has a close relation to science and belongs to its history.

Foucault's third point in his list says that 'by rectifying its errors... discourse does not necessarily undo its relations with ideology. The role of ideology does not diminish as rigour increases and error is dissipated' (Foucault 1972 [1969], p. 186). This reads as a frontal attack on Bachelard, even in its language. For Bachelard, science, that is true discourse, is obtained precisely by 'rectification' of errors. Canguilhem agreed with Bachelard that science can and does 'undo its relations' with non-scientific discourse. Canguilhem would never accept Foucault's view of science as simply as 'one practice among others', as the latter remarked in the following point of his list. It might then be surprising that he also said that it agreed with Foucault that science does not 'necessarily' eliminate all its links with ideology (Canguilhem 1978, p. 59). However, Canguilhem conceived of ideology as

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<sup>15</sup> Foucault famously opposed Caivailès, Bachelard, Canguilhem and Koyré's philosophy of knowledge, rationality and concept to Sartre and Merleau-Ponty's philosophy of the subject and experience. (Foucault 1985, p. 4). Elisabeth Roudinesco has rightly remarked that Canguilhem had already written about these two traditions in the book that collects his eulogies of Jean Cavaillès. (Roudinesco 2008, p. 2); (Canguilhem 1996 [1976]).

<sup>16</sup> On this point, see (Delaporte 1998, pp. 287ff.), and (Davidson 1998, pp. 193ff.).

scientific ideology, and the latter is not anti-science, indeed it has broken its links with anti-science, superstition, and in general with irrational practices. Moreover, when science emerges, it substitutes ideology on a certain domain, as discussed. Science might not manage to undo all its links with ideology, but is certainly aimed at doing so, and it can succeed, whereas for Foucault it is impossible to conceive of science as being dissociated from ideology.

Foucault's fourth point stands in a complex relationship with Bachelard's and Canguilhem's philosophies. Here I would like to highlight one aspect that clearly marks his disagreement with Canguilhem. Foucault writes that '[t]o tackle the ideological functioning of a science in order to reveal and to modify it is not to uncover the philosophical presuppositions that may lie within it...'. This in fact is what Canguilhem had done, for instance in "Une idéologie médicale exemplaire, le système de Brown" (Canguilhem 1993 [1977], pp. 47-54); (Canguilhem 1988 [1977], pp. 41-50). In this article Canguilhem proposed an example of a scientific ideology in medicine. He defined scientific ideology once again as 'a discourse that parallels the development of a science and that, under the pressure of pragmatic needs, makes statements that go beyond what has actually been proved by research' (Canguilhem 1988 [1977], pp. 57-8). The ostensive question of the article is how the medical theories of John Brown (1735-1788), all but forgotten now, could be so popular for a time in a number of countries, but not in France.<sup>17</sup> However, Canguilhem there also denounced once again the ideology of 'medicine's unlimited power' held by the most influential nineteenth-century French physiologists, including Claude Bernard, and by Auguste Comte. Canguilhem did precisely what Foucault criticised: he uncovered the philosophical assumptions at the core of this ideology, namely the principle of the identity of the normal and pathological organic phenomena. I have referred to the article on John Brown because Canguilhem there employed the term 'ideology', but in fact in *The Normal and the Pathological*, he went deeper in uncovering the philosophical assumptions behind nineteenth-century medical theories.<sup>18</sup> There he explained that the assumption of the continuity between normal and pathological phenomena in turn rested on the emergence of 'rational optimism' that denied the reality of evil (and therefore of disease). Nineteenth-century medical theories, supported by their rational and secular optimism, rejected previous dualistic theories. For him the latter theories were influenced by a religious, 'Manichean' view that saw Health and Disease fight over human beings just as Good and Evil fight over the world (Canguilhem, 1999 [1966], p. 61).

Canguilhem perfectly understood that Foucault's criticism was directed at him. In fact, in the Preface of *Ideology and Rationality* he referred to the very pages of the *Archaeology of Knowledge* that I have

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<sup>17</sup> Dagognet has remarked that in his article on John Brown Canguilhem went beyond Bachelard's psychoanalysis of the mind and considered social and cultural explanations for the fortune of theories (Dagognet 1985, pp. 35-6).

<sup>18</sup> Canguilhem refers to *The Normal and the Pathological* in his article on John Brown (in the last footnote).



just discussed.<sup>19</sup> While conceding that perhaps he had not paid enough attention to the ‘thresholds of transformation’ in the history of science, that is to Foucault’s interpretative model, he expressed once again his belief that Claude Bernard’s medicine and Louis Pasteur’s microbiology cannot be regarded as having contributed similarly little to medicine’s scientificity.<sup>20</sup> Here Canguilhem did not just disagree with Foucault on Pasteur’s importance for the history of medicine. Rather, he asserted his epistemological view of the history of science and evaluated the two doctrines accordingly: Bernard’s as an ‘ideology’, in his newly-acquired vocabulary, that is as a theory in which philosophical assumptions are the guiding force when experimental evidence and properly scientific method are lagging behind, and Pasteur’s as a science, deriving from the positive results of scientific research. Canguilhem did not change his approach under the pressure of the brilliance of the new star of French philosophy. He wrote that he could not accept a history in which science is not distinct from literature, even if this would earn him ‘the distinction of being a “conceptualist fossil”’. His allegiance was to the epistemological history of science, and to Gaston Bachelard (Canguilhem 1993 [1977], p. 9); (Canguilhem 1988 [1977], p. ix)

However, when it comes to the object of the history of science, Canguilhem’s approach appears to be far more liberal and inclusive than Bachelard’s. Indeed, while once again paying homage to the latter by accepting the distinction between sanctioned and lapsed history, Canguilhem still argued that these two histories are also interlocked. Etienne Balibar has stressed this point, emphasising that for Canguilhem the history of truth cannot only contain the truth (or true theories) and the history of science cannot only narrate science (Balibar 1993, p. 66). This is correct, but it does not emphasise what distinguishes Canguilhem from Bachelard (and Althusser). It is not only the case that Canguilhem’s history of science contains errors and non-scientific theories, but it contains scientific ideology, and for Canguilhem scientific ideology is not error, nor an epistemological obstacle, but it is rather the (inadequate) product of reason. Its role in the history of science can be positive, at least as far as the ideology that precedes science is concerned.

For Bachelard the history of science includes error in the form of epistemological obstacles that science must overcome. In this sense, epistemological obstacles are part of the history of science, but

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<sup>19</sup> Canguilhem explicitly referred to Foucault’s discussion of the thresholds of transformation provided in *The Archaeology of Knowledge* (threshold of positivity, epistemologization, scientificity and formalization), and even provided page numbers (pp. 243-247 of the French edition of *L’archéologie du savoir*) (Canguilhem 1993 [1977], p. 10). This precise reference has however been omitted from the English translation (Canguilhem 1988 [1977], p. x); it would have been: (Foucault 1972 [1969], pp. 186ff.). Canguilhem was also familiar with Foucault’s subsequent use of the concept of threshold [*seuil*]. As director of the Institut d’histoire des sciences of the University of Paris, he hosted the conference on Cuvier where Foucault presented his view of the role of Cuvier in the history of biology in relation to Darwin’s evolutionism. Foucault’s interpretation was based on his concepts of epistemological and ontological thresholds. Canguilhem, as the host, kept an extremely low profile, as shown by the minutes; see (Foucault 1970).

<sup>20</sup> Here Canguilhem is responding to Foucault’s suggestion in (Foucault 1972 [1969], p. 188).

only in a negative way. Moreover, they do not have a history themselves, for they proceed from permanent characteristics of our mind, as mentioned. Of epistemological obstacles one can make a museum (in fact, a museum of 'horrors'), not a history (Bachelard 1993 [1938]). The 'prescientific mind' (or mentality), which is still dominated by the imagination, for Bachelard produces mere opinion, and science is in a position of 'absolute' opposition to opinion. Opinion, writes Bachelard, 'thinks badly, it does not think'; it rather transforms needs into something that it calls knowledge (Bachelard 1993 [1938], p. 14). Once again, this is closer to Althusser's 'ideology', which 'expresses a will (conservative, conformist, reformist or revolutionary), a hope or a nostalgia, rather than describing a reality' (Althusser 1969 [1965], p. 234). Unlike Bachelard, Canguilhem was prepared to include in the history of science attempts in the search for truth that ultimately fell short of science, but that for him nevertheless proceeded from rationality.

## 7. Conclusion

Canguilhem's 'refurbishment without rejection' of Bachelard's philosophy through the concept of scientific ideology is more important than it might at first appear. However it does not mark a change in his own view, as he himself emphasised (Canguilhem 1993 [1977], p. 9). The epistemological problems that he faced had emerged in his previous work, as shown with regard to *La formation du concept de réflexe*. He accepted much of Bachelard's epistemology, including the normative approach to the history of science. However, Bachelard's dichotomy between reason and the imagination, and the corresponding dichotomy between science and the works of the imagination, if taken in their original forms, would have made the construction of historical narratives rather difficult. In fact, Bachelard wrote extensively on the works of the imagination, but in two ahistorical registers: the first is as a catalogue of ahistorical epistemological obstacles, as he did in *The Formation of the Scientific Mind*, and *The Psychoanalysis of Fire* (Bachelard 1949 [1938]), the second is an equally ahistorical phenomenology of the imagination, divorced from scientific rationality, as for instance in *The Poetics of Space* and *The Poetics of Reverie* (Bachelard 1960, 1964 [1957]). His works on science are mainly on modern science, as this is for him the only science.

Canguilhem's history of science is far more inclusive than Bachelard's, as well as chronologically much longer. Where Bachelard saw the works of the imagination, Canguilhem often saw the works of rationality that was still missing methods and tools to achieve fully scientific results. Canguilhem was happy to discuss medicine from the Hippocratic tradition onwards; he did see discontinuities, even recent ones, as discussed in relation to Claude Bernard, but refused to expel many theories and practices that predate a break from the history of the discipline. He rather labelled them as 'scientific

ideologies'. It would have been hard to create any sort of historical narrative otherwise. If he had strictly applied Bachelard's epistemology, he could have never created a continuous narrative between the modern concept of reflex movement and Thomas Willis's. His view of science as critical thinking enabled him to have a more positive view of past achievements. In Thomas Willis' work, he did not only see a rather bizarre (by modern standard) theory of life as light, but also an effort to explain the phenomenon of the reflex movement in a rational way, which yielded a concept that could then be re-interpreted within a properly scientific context. When discussing Bachelard's epistemology, Canguilhem emphasised the impact it had on the writing of history of science: after Bachelard, the focus is, he wrote, on 'conceptual filiations' and their discontinuities (Canguilhem 1994 [1968], p. 184). Canguilhem's stress on concepts is revealing, as he wrote histories of concepts. In this, he was Bachelard's heir. However, unlike Bachelard, he did not focus on the 'mind'. For Bachelard a non-scientific mind does not create science, or scientific concepts, as it is dominated by the imagination rather than by reason. Canguilhem focused on concepts, and was far less concerned than Bachelard was about the type of mind that creates them.

A crucial reason for the tension between Bachelard's and Canguilhem's respective views of science and its history is that their aims were rather different. In *La formation du concept de réflexe*, Canguilhem aimed at constructing a faithful history of a concept, and did so by employing epistemology, because he thought that an epistemological analysis of concepts would indeed produce a true history. Historians may be startled at his claim that 'the rights of logic' should not give in to 'the rights of the logic of history' (Canguilhem 1977 [1955]). Canguilhem did not disregard history; on the contrary, he thought that mere historical analysis stops at the surface (for instance at terminology) and does not really grasp the concept of which it is supposed to do a history. His other aim was to establish which 'organizing concept'<sup>21</sup> is fully scientific, as he did with regard to the concepts of normal and pathological. It goes without saying that these two aims could not be achieved separately.

Bachelard's aims are epistemological, ethical and pedagogical. He spent much intellectual energy on the analysis of what he saw as the irrational sources of past theories, practices and indeed social relations between researchers. Current science for him could show how to think and how to control unconscious drives and emotions, which should be relegated to the private sphere. For him, sanctioned history plays an educational role, while lapsed history can play none (Bachelard 1951, p. 25); 'recurrent, judged' history is a barrier that defends the conquests of rationality against regress towards irrationalism (Bachelard 1951, pp. 26-7). His positive focus was on current chemistry and

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<sup>21</sup> I take the expression 'organizing concept' directly from Ian Hacking (Hacking 1999), and indirectly from Foucault.

physics especially, because for him these sciences are in a position to teach the philosopher how to think rationally and creatively.

Canguilhem, on the other hand, did not regard the history of science as a pedagogical tool. His histories are not aimed at building 'barriers' against irrationalism, although they may and do show the progressive path of rationalisation. Indeed, his own vitalism, however rationalistic,<sup>22</sup> could be seen as the reinterpretation of an outdated doctrine. But he was not the only one among French historians and philosophers of science to think that both science and philosophy could advance in this way. Just to mention one, H  l  ne Metzger read Newton's physics as advancing by recuperating the century-old (mystic) conception of action at a distance within the new context of Boyle's corpuscular philosophy and Kepler's astronomy (Metzger 1938).

The concept of scientific ideology could serve as a corrective for what for Canguilhem were the too severe historiographical consequences of the normativity at the centre of historical epistemology. Without this corrective, it would have been difficult to justify the narratives he constructed, like that of the concept of reflex movement, and arguably his own philosophy. This is because these narratives exhibit some continuity across centuries, and include concepts born out of theories that do not conform to the norm of modern science. Canguilhem needed a new category for a class of theories that are not expelled from the history of science, but at the same time are not granted the status of science. In this, the concept of scientific ideology was a possible solution. Canguilhem used the category of scientific ideology in order to develop historical epistemology in a direction that in fact fitted with his own historical work.

While I have downplayed the importance of the difference between the history of the life sciences and medicine with that of the 'hard sciences' with regard to discontinuities and maturity, I think other aspects of these sciences exerted a profound influence on Canguilhem's epistemological as well as historiographical views, as I have discussed elsewhere (Chimisso 2014). Canguilhem had a less clear-cut notion of the distinction between truth and error than Bachelard, because he focussed on the life sciences and medicine. In these disciplines, which are concerned with life and with events that are never precisely repeated, it is difficult to draw clear lines between truth and error, and to have norms that are precise and universal.<sup>23</sup> Towards the end of his life, he summarised the importance of error in the history of medicine by saying that error is not only the risk of a discourse aimed at the truth (that is, of science), but that error is characteristic of the living being before being characteristic of the

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<sup>22</sup> The interplay of rationality and life is at the centre of Canguilhem's philosophy, which famously has been called 'vital rationalism' (Rabinow 1994) and 'rational vitalism' (Dagognet 1985, p. 32). See also (Dagognet 1997, p. 201).

<sup>23</sup> Error is a very complex topic in Canguilhem. There is a large literature on Canguilhem's concept of error. Famously, Foucault called Canguilhem's 'a philosophy of error' (Foucault 1985: 14). See also (Talcott 2013); (Gayon 1998); (Lecourt 2008); (Le Blanc 2002, pp. 276ff.).

scientist (Canguilhem 1987). When discussing normativity in medicine and psychiatry – that is what should be considered ‘normal’ in those fields – Canguilhem gave subjectivity an important role to play. But subjectivity was the very thing that Bachelard aimed to expel from science. Moreover, Canguilhem recognized that different situations in life call for different sets of norms. The life of a diabetic is ‘normal’ and so is the life of a non-diabetic, but these are two different normalities, as the lives of these two individuals are regulated by different norms. Indeed, each individual lives at the crossroad of social, biological, economic and individual norms.<sup>24</sup> Unlike Bachelard’s scientific object, modelled on physics and chemistry, Canguilhem’s, modelled on physiology and medicine, is never really rationalized and purified. His object is also a subject, aware of her ‘pain and angst’ (Canguilhem, 1994 [1968], p. 409). This ‘residue’ of subjectivity and impurity, as it were, cannot be seen just as an epistemological obstacle, for it is part of the object of medicine and psychiatry. Just as the object of these sciences, the object of the historian of these sciences cannot be completely purified and rationalized; in fact the latter – the history of the life sciences and medicine - includes not only truths, but also attempts at the truth.

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<sup>24</sup> Canguilhem discussed these themes in his most famous book, (Canguilhem 1999 [1966])

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