

The London School of Economics and Political Science

Georges Canguilhem: Norms and Knowledge in the Life Sciences

Marina C. Brilman

A thesis submitted to the Department of Law of the
London School of Economics for the degree of Doctor of
Philosophy, London, March 2009

UMI Number: U615946

All rights reserved

INFORMATION TO ALL USERS

The quality of this reproduction is dependent upon the quality of the copy submitted.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if material had to be removed, a note will indicate the deletion.



UMI U615946

Published by ProQuest LLC 2014. Copyright in the Dissertation held by the Author.
Microform Edition © ProQuest LLC.

All rights reserved. This work is protected against
unauthorized copying under Title 17, United States Code.



ProQuest LLC
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106-1346

THESES
F
9078



1200143

Declaration

I certify that the thesis I have presented for examination for the PhD degree of the London School of Economics and Political Science is solely my own work other than where I have clearly indicated that it is the work of others (in which case the extent of any work carried out jointly by me and any other person is clearly identified in it).

The copyright of this thesis rests with the author. Quotation from it is permitted, provided that full acknowledgement is made. This thesis may not be reproduced without the prior written consent of the author.

I warrant that this authorization does not, to the best of my belief, infringe the rights of any third party.

Abstract

In the second half of the twentieth century, the interest of the social sciences in the life sciences has intensified. This intensification might be explained through the idea that, as Michel Foucault puts it, what defines modern rationality is the entry of 'life' into regimes of knowledge and power. I argue that this 'entry' can be traced back to the work of Immanuel Kant. He established the autonomy of reason by simultaneously including and excluding life from reason. Kant explained the emergence of reason by likening it to a biological process but then excluded such processes from reason through his notion of the 'lawfulness of the contingent'. I argue that this two-pronged approach leads to a recurring negotiation of the relation between life and knowledge in the contemporary life and social sciences.

I argue that it was not Foucault who directly engaged with how the life sciences lie at the heart of modern rationality. Rather, it was the French philosopher and historian of science Georges Canguilhem. I argue that he questioned modern rationality by inquiring into some of its most fundamental epistemological or discursive forms. In order to illustrate this, I address his inquiry into the concepts of environment, individuality, knowledge or information, and normativity. The potential of these concepts to migrate across disciplinary boundaries is indicative of the fact that the productivity of Canguilhem's work extends far beyond the life sciences.

Acknowledgements

I thank my doctoral supervisors Alain Pottage and Emmanuel Melissaris. I am grateful to Alain Pottage for his comments on drafts of this thesis and for discussions on various aspects of it. I also thank him for sparking my interest in Canguilhem many years ago in a course on law and social theory at the LSE. I benefited from discussions on the life and social sciences with the participants of the BIOS reading group at the LSE. I thank my family, friends, and fellow PhD candidates for moral support.

This work was funded by the London School of Economics and Political Science, Prins Bernhard Cultuurfonds, Olive Stone Memorial Scholarship, Dr. Hendrik Muller's Vaderlandsch Fonds, and the Sir Richard Stapley Educational Trust. I thank all of these institutions for their financial support.

TABLE OF CONTENTS

Declaration.....	2
Abstract.....	3
Acknowledgments.....	4
CHAPTER 1. Introduction - Georges Canguilhem: Norms and Knowledge in the	
Life Sciences	11
1.1 Introduction	
1.1.1 The thesis.....	11
1.2 A short biography	
1.2.1 Canguilhem's ' <i>vita activa</i> '.....	15
1.2.2 Canguilhem's ' <i>vita contemplativa</i> '.....	20
1.3 Intellectual lineage	
1.3.1 Canguilhem as 'precursor' to Foucault.....	22
1.3.2 Countrymen: mentors and pupils.....	23
1.3.3 The German connection: scientists and philosophers.....	26
2.1 A methodology not limited to method	
2.1.1 The characteristics of concepts.....	29
2.1.2 Acting through concepts or concepts as actors?.....	31
2.1.3 The vitality of concepts.....	33
2.1.4 Concepts as problems.....	35
2.1.5 Concepts as 'unification of a manifold'.....	36
2.1.6 A manifold of concepts.....	37
2.1.7 A continuous concept: the ' <i>vivant</i> '.....	38
2.2 What happens when life becomes subject?	
2.2.1 The ' <i>vivant</i> ' as subject.....	40
2.2.2 The significance of the 'reflex'.....	41
3.1 The negotiation of life in social science	
3.1.1 Biocapital and facts of life that travel.....	42
3.1.2 'New epistemologies of life' - a change in scale.....	43
3.2 What to do with heritage?	
3.2.1 The consequences of heritage.....	44

4.1 An overview of chapters	
4.1.1 Life sciences and modern rationality.....	46
4.1.2 The problem of ‘environment’.....	47
4.1.3 The problem of ‘individuality’.....	48
4.1.4 The problem of ‘information’.....	49
4.1.5 The problem of ‘normativity’.....	50
CHAPTER 2. Life Sciences and Modern Rationality.....	52
1.1 Introduction	
1.1.1 The ‘threshold of modernity’	52
1.2 A curious analogy	
1.2.1 The origin and the analogy.....	54
1.2.2 The justifications for critique.....	56
1.2.3 The first <i>Critique</i>	58
1.2.4 The appearance of the analogy.....	59
1.3 Different scenarios	
1.3.1 Three biological processes.....	60
1.3.2 Between clarification and distraction.....	62
1.3.3 The life sciences at the time.....	64
1.3.4 The meaning of the analogy.....	66
1.3.5 The architectonic and the organic.....	67
1.3.6 Unintended consequences.....	68
2.1 The third <i>Critique</i>	
2.1.1 The ‘lawlikeness of the contingent’.....	70
2.1.2 Including through excluding.....	72
2.2 The unification of the manifold	
2.2.1 The principle of purposiveness.....	74
2.2.2 The living subject to judgment.....	76
2.2.3 The unity of diversity.....	77
2.3 Identifying what Kant is identifying	
2.3.1 Negotiating the <i>a priori</i>	79
3.1 Opening up the question for questioning	
3.1.1 The articulation of a relation.....	81
3.1.2 The modern representation of ‘life’	83

4.1 Canguilhem's lateral engagement	
4.1.1 The French critique of <i>Critique</i>	87
4.1.2 The 'possibility of possibility'.....	88
4.1.3 Canguilhem's vital politics.....	89
Conclusion	91
 CHAPTER 3. The Environment	 93
1.1 Introduction	
1.1.1 The problematic notion of 'environment'.....	93
1.1.2 A 'category of contemporary thought'.....	95
1.1.3 The ambiguity of 'milieu'.....	96
1.1.4 Consequences of conceptualizing 'environment'.....	96
1.2 Traditional representations of 'milieu'	
1.2.1 The environment as resource or 'conditions of life'.....	98
1.2.2 The environment as space or location.....	100
1.2.3 The environment and action.....	102
2.1 A history of aether	
2.1.1 The dynamic origins of 'milieu'.....	104
2.1.2 The aether as 'milieu'.....	106
2.1.3 'Milieu' as medium.....	108
2.1.4 'Milieu' as environment.....	111
2.2 New ways of imagining 'milieu'	
2.2.1 The 'internal milieu'.....	113
2.2.2 The 'associated milieu'.....	116
2.2.3 The influence on - and of - the 'associated milieu'.....	119
3.1 The 'environment' in Luhmann's social theory	
3.1.1 Autopoiesis and 'environment'.....	123
3.1.2 Traditional characteristics of 'milieu'.....	124
3.2 The central role of 'environment'	
3.2.1 Consequences of 'environment' as centre.....	128
3.2.2 Maintenance of purposeful obscurity.....	130
4.1 The 'environment' and modern rationality	
4.1.1 'Environment' and the state of man.....	133
4.1.2 A biological concept of environment.....	135
Conclusion	136

CHAPTER 4. The Individual.....	138
1.1 Introduction	
1.1.1 Individuality in the life sciences.....	138
1.1.2 The individual as ‘paradigm’.....	141
1.1.3 The ‘problem of individuality’.....	143
2.1 The individual in Kant	
2.1.1 Identity, unity, autonomy.....	144
2.1.2 The ‘unity of diversity’ or ‘system’.....	146
2.2 Kant’s influence	
2.2.1 The individual as subject.....	148
2.2.2 The identity and integrity of the organic ‘self’.....	149
2.2.3 The individuality of the ‘gene’.....	150
2.2.4 The individuality of the ‘system’.....	151
2.2.5 Networks and pathways.....	152
2.3 The individual in Nietzsche	
2.3.1 The process of ‘self-overcoming’.....	154
3.1 The history of the concept of the cell	
3.1.1 Subjectivity and ontology.....	158
3.2 Aspects of individuality	
3.2.1 Continuity and discontinuity.....	162
3.2.2 The imagery of the individual.....	165
3.2.3 Political philosophy and biology.....	166
3.2.4 The indivisible individual.....	168
4.1 The individual as process	
4.1.1 Simondon: ‘ <i>l’individu n’est pas un être mais un acte</i> ’.....	170
4.1.2 Foucault: ‘ <i>techniques de soi</i> ’.....	173
4.1.3 The autopoietic ‘system’; individuality as differentiation.....	175
Conclusion.....	179
 CHAPTER 5. Information and Knowledge of Life.....	 181
1.1 Introduction	
1.1.1 Information in contemporary biology.....	181
1.1.2 Information and control.....	183

1.2 The different forms of Aristotelian form	
1.2.1 Aristotle's idea of form.....	186
1.2.2 Form as an active principle.....	188
1.2.3 Buffon's ' <i>moule intérieur</i> '.....	190
2.1 Two lines of inquiry	
2.1.1 Information as metaphor.....	192
2.1.2 Form abstracted from matter.....	197
2.2 From form to information	
2.2.1 Form as information.....	199
2.2.2 Form without purpose.....	200
2.2.3 Form as organization.....	202
2.2.4 Information and individuation.....	203
3.1 Canguilhem and information	
3.1.1 A return to Aristotelian form?.....	205
3.2 Information and 'knowledge of life'	
3.2.1 The problem of knowing life.....	208
3.2.2 Using Aristotle to criticize Kant	211
3.2.3 Knowledge and error.....	215
Conclusion.....	219
CHAPTER 6. Normativity.....	220
1.1 Introduction	
1.1.1 The special status of normativity.....	220
2.1 The genealogy of 'vital normativity'	
2.1.1 Kant and the normative.....	222
2.1.2 Nietzsche and normativity.....	223
2.1.3 Nietzsche and life as 'will to power'.....	226
2.2 Traditional interpretations of the normative	
2.2.1 The distinction between norm and fact.....	228
2.2.2 Normativity as control.....	229
2.2.3 'Biopower' as power over life	232
3.1 The history of 'vital normativity'	
3.1.1 The normal and pathological.....	235
3.1.2 The ambiguity of the normative.....	237
3.1.3 A biological concept of the norm.....	238

3.2 Canguilhem's 'vital normativity'	
3.2.1 Normativity as 'technique' of living.....	239
3.2.2 Social and vital norms.....	243
4.1 Normativity: 'biopower' and 'contingency'	
4.1.1 Foucault's 'biopower'.....	247
4.1.2 Normativity and contingency.....	249
Conclusion	254
CONCLUSION	256
Bibliography	263

1. INTRODUCTION - GEORGES CANGUILHEM: NORMS AND KNOWLEDGE IN THE LIFE SCIENCES

PART I

1.1 Introduction

1.1.1 *The thesis*

Georges Canguilhem is one of the most productive thinkers for the contemporary life and social sciences. This may seem a strange statement when we consider that he is not, by any means, the most discussed theorist these days. He is usually regarded as a precursor to the more well-known and popular Foucault. Why is there no real engagement with Canguilhem's work, except by a small group of enthusiasts,¹ at a time when that work seems so distinctly relevant?

Even for those who generally dislike French philosophers, Canguilhem's work should come as a pleasant surprise. He does not fit the profile of the self-professed French intellectual that is both loved and loathed abroad, most notably represented by Canguilhem's former classmate Jean Paul Sartre.² Nor does he form part of the younger generation of philosophers such as Foucault or Derrida. Canguilhem's way of philosophizing is - by his own admission - rather unfashionable³ and his style of writing is rigorous,⁴ seemingly apolitical, and has an elegance from days long gone.

¹ See e.g. contributors to Balibar, Cardot, Duroux et al. (Eds.) (1993); Bing, Braunstein & Roudinesco (Eds.) (1998).

² Macey (1998), p. 172.

³ Canguilhem (1976), p. 71: 'Everything "natural" is fashionable. Is this mere fact sufficient for the philosopher to reject these things as objects of inquiry? ... But to take as his object of reflection a fashionable phenomenon does not oblige the philosopher in any way to philosophize in a fashionable manner. It is possible to proceed with a critical analysis of such phenomena with a relentless rigor for which Kantian philosophy, in different times and regarding different questions, has served as an example.' (My translation).

⁴ Lecourt (1975), p. 163: 'It does not invite reverie, it does not even urge meditation: it *demand*s of the reader that he set himself to work.'

The influence of his thought has remained limited outside of France partly because his, arguably, most interesting work remains to be translated.⁵ But why have some of those who *are* aware of his work made so little of it? Canguilhem's work has been portrayed as having merely general or residual significance; as if it offers no more than an open-ended invitation to think about the life sciences.⁶ His work on normativity in the life sciences,⁷ usually regarded as his main contribution, is thought to have become obsolete in light of recent developments in those sciences.⁸ It is suggested that the main merit of this work might be that it inspired Foucault's discussion of normalizing practices.⁹ Not only do such interpretations miss out on some exquisite thinking about specific problems that straddle the life and social sciences, they also fail to recognize the wider significance of Canguilhem's engagement with modern rationality.

Many writings in the social sciences that focus on the life sciences inquire into technological developments and the changing forms of biological entities or processes.¹⁰ The effort to keep up with 'molecularization',¹¹ fragmentation, and contingency seems to make a certain kind of theory obsolete. A theory that proceeds by means of concepts, regarded as preserved problems, rather than by analytic dissection. So why would Canguilhem's work be relevant for the contemporary life and social sciences, especially since he wrote his last essays several decades ago? This question can only be answered through a short detour.

The interest of the social sciences in the life sciences has intensified from the second half of the twentieth century onwards. Perhaps this is simply because the life sciences did not exist as such until relatively recently.¹² However, it could also be argued that the life sciences are definitive of the twentieth century,¹³ or - in Heidegger's words - that they form part of 'the phenomena that distinguish the age'.¹⁴ Whatever the case may be, there is little (self-) reflection within the social sciences on this recent interest in the life sciences. Nonetheless,

⁵ Canguilhem (2003) and (2002) have not been translated, although segments have been published in Canguilhem (1994a).

⁶ Rabinow & Caduff (2006), p. 330.

⁷ Canguilhem (2006).

⁸ N. Rose (1998), pp. 161-162; N. Rose (2001), pp. 15-16 and 21; Rabinow (1998), p. 199.

⁹ N. Rose (1998), pp. 164-165.

¹⁰ N. Rose (2007); Sunder Rajan (2006); Parry (2004a); Thacker (2005).

¹¹ N. Rose (2001), p. 13.

¹² See, e.g., Chapter 2, para. 1.3.3 on the relatively recent origins of 'biology' as a discipline.

¹³ Dagognet (1985), p. 29: Each century has a science that defines it and a philosopher most suited to address the questions that it gives rise to.

¹⁴ Heidegger (1977), p. 115.

the effects of the life sciences on subjectivity,¹⁵ forms of capitalism,¹⁶ and notions of power and control¹⁷ have become important objects of discussion.

To the extent that some theoretical justification is sought for such recent interest, reference is often made to Foucault's statement that modernity is defined by 'the entry of life into history, that is, the entry of phenomena peculiar to the life of the human species into the order of knowledge and power'.¹⁸ However, it is not entirely clear what this statement might mean. Foucault himself does not offer an explanation but presupposes a particular relation between modern rationality and the life sciences without inquiring in any detail into the origins and heritage of this relation.

In the last essay that he agreed to publish before his death, Foucault hints at the significance of Canguilhem's work. He observes that Canguilhem's ideas are very influential in French academic circles despite the fact that his exclusive focus on the life sciences seems to necessarily limit the range of his work. The philosophy of science does not normally attract much attention, as Foucault observes: 'there have been noisier theatres: psychoanalysis, Marxism, linguistics, ethnology'.¹⁹ He notes furthermore:

[F]rom this, a paradox: this man, whose work is austere, intentionally and carefully limited to a particular domain in the history of science, which in any case does not pass for a spectacular discipline, has somehow found himself present in discussions where he himself took care never to figure.²⁰

How might this paradox be explained? Foucault's work is not explored in this thesis, although specific references to it are made. However, I use his suggestion that the influence of Canguilhem's work can be explained by the way in which that work engages with modern rationality (following a French tradition in the history and philosophy of science).²¹ Foucault would probably agree that Canguilhem is, at least in this respect, actually more interesting for the social sciences than Foucault himself. It must be pointed

¹⁵ N. Rose (2007); N. Rose & Novas (2004).

¹⁶ Sunder Rajan (2006); Franklin & Lock (2003).

¹⁷ Rabinow & Rose (2006); Kay (2000).

¹⁸ Foucault (1998), pp. 141-142.

¹⁹ Foucault (1978), p. ix.

²⁰ Ibid.

²¹ Ibid, p. xi.

out that the association of modernity with rationality is, of course, only one example of what Luhmann calls a 'repertoire of societal self-descriptions'.²²

In this thesis, I explore how Canguilhem questions the relation between modern rationality - broadly defined as the particular idea of reason that is most often associated with the Enlightenment - and the life sciences. Heidegger observes that:

[M]etaphysics grounds an age, in that through a specific interpretation of what is and through a specific comprehension of truth it gives to that age the basis upon which it is essentially formed. This basis holds complete dominion over all the phenomena that distinguish the age. Conversely, in order that there may be an adequate reflection upon these phenomena themselves, the metaphysical basis for them must let itself be apprehended in them.²³

I argue that the life sciences are not only a phenomena that distinguishes our age, but that these sciences in some way contributed to the formation of its 'metaphysical basis'. I argue that the relation between knowledge and living processes that characterizes modern rationality was first formulated, or in any case expressed most clearly, by Kant. I do not seek to either question or presuppose the significance of Kant as an author or philosopher but to address the architectonic principle - the metaphysical basis - that seems to emerge from his work. I argue that Kant's simultaneous exclusion and inclusion of living processes from his theory of understanding lays the basis for the negotiation of the relation between knowledge and living processes that characterizes most recent inquiries in the life and social sciences.

I argue, furthermore, that Canguilhem engages with this particular type of rationality by identifying and transforming some of the basic concepts through which it functions. I illustrate this by addressing some concepts or problems that play an important role in the life and social sciences: environment, individual, knowledge or information, and normativity. These concepts do not precisely map onto some of the specific concepts that Canguilhem 'traces' in his various essays. Rather, they can be regarded as 'second-order' concepts,²⁴ 'categories',²⁵ or 'paradigms'²⁶ around which Canguilhem structures his ideas and that resurface at different points in his work. They are not necessarily derived from

²² Luhmann (1998), p. 2: 'In attempts to characterize modernity, features are employed that originate from the repertoire of societal self-descriptions. This is true, for example, of the association of the concept of modernity with the conceptual world of the rational Enlightenment.'

²³ Heidegger (1977), p. 115-116.

²⁴ Luhmann (1998), p. 7: these concepts allow Canguilhem to observe his own observing of specific concepts; to trace such specific concepts and make them understandable by reference to a wider question or problem.

²⁵ See Chapter 3, para. 1.1.2 on Canguilhem's use of that word.

²⁶ See Chapter 2, para. 1.1.2 on Agamben's use of that word.

either the life or social sciences, even if they are elaborated by Canguilhem with reference to these sciences.²⁷ These concepts are the real actors in what follows rather than the philosopher Georges Canguilhem; Canguilhem functions as the ‘persona’ through which these concepts can be explored.

It has been suggested that the influence of the life sciences on the social sciences in the nineteenth century could be explained by reference to the ‘comprehensive, transferable character of biological concepts’.²⁸ Such a ‘unilateral’ transgression of disciplinary boundaries by concepts from the life sciences to the social sciences is not explored here. Rather, I argue that Canguilhem questions - through the life sciences - some basic epistemological or discursive forms. These forms or concepts migrate and circulate free from the constraints of institutionally defined disciplines. They function irrespective of relatively recent disciplinary boundaries, biases, and epistemological frontiers.²⁹ In the identification and discussion of these concepts, and the questioning of the rationality they propose, lies the unique significance of Canguilhem’s work for the contemporary life and social sciences.

1.2 A short biography

1.2.1 Canguilhem’s ‘vita activa’

Arendt’s discussion of the distinction between ‘*vita activa*’ and ‘*vita contemplativa*’ that structured the understanding of life in ancient Greece³⁰ can be used to understand the relation between Canguilhem’s life and work. *Vita activa*, also called ‘*bios politikos*’ by Aristotle, signified a ‘life devoted to public-political matters’³¹ while *vita contemplativa* referred to the life of the philosopher who distanced himself from active involvement in

²⁷ Much has been made, too much I believe, of Canguilhem’s distinction between the social and the vital in ‘*Du social au vital*’, Canguilhem (2006), pp. 175-191. This part of his discussion proves Canguilhem’s continuous preoccupation with the mutual information of the social and the vital (see Chapter 6, para. 3.2.2).

²⁸ Foucault (1989), pp. 41. Foucault argues against this and says that such influence can be explained by ‘the fact that these concepts were arranged in a space whose profound structure responded to the healthy/morbid opposition ... one did not think first of the internal structure of the *organized being*, but of the *medical bipolarity of the normal and the pathological*’, thereby implicitly affirming the significance of Canguilhem’s work ‘*Le normal et le pathologique*’ (2006).

²⁹ See Bachelard (1970) for a beautiful discussion of the notion ‘*frontière épistémologique*’.

³⁰ Arendt (1998), p. 7. It differs from the distinction between ‘*zoe*’ and ‘*bios*’, *ibid.*, p. 97; subsequently discussed by Agamben (1998), p. 1: ‘*zoe*, which expressed the simple fact of living common to all living beings... and *bios*, which indicated the form or way of living proper to an individual or a group’.

³¹ *Ibid.*, p. 12.

worldly goings-on. Arendt argues that the beginning of the modern age, which she locates somewhere in the seventeenth century, was characterized by a 'reversal of the hierarchical order' between *vita contemplativa* and *vita activa*.³²

Whereas the latter previously had a slightly negative connotation (even before it lost its original meaning and came to signify mere activity or 'business'),³³ *vita activa* now became increasingly significant. Arendt observes: 'the point was not that truth and knowledge were no longer important, but that they could be won only by "action" and not by "contemplation"'.³⁴ She notes that the distinction was now one between thinking - rather than contemplation - and doing because contemplation 'in the original sense of beholding the truth, was altogether eliminated'.³⁵ One of the consequences of this reversal in hierarchy between *vita activa* and *vita contemplativa* was that experimentation and the use of instruments in the generation of knowledge became much more important. Another consequence, Arendt argues, was a rupture between philosophical and scientific ways of knowing.³⁶

Canguilhem's life and work challenge the distinction between *vita activa* and *vita contemplativa* and illustrate the entanglements of action and contemplation, as well as scientific and philosophical ways of knowing. Although Canguilhem regards philosophy as contemplation in the traditional sense of 'beholding truth',³⁷ he believes at the same time that seeking truth requires action. Not action as involvement in public life or as activity or business. Rather, action as active engagement which differs from the 'witnessing' of events that traditionally defines the engagement of the intellectual.³⁸ Moreover, Canguilhem's work shows how the importance of the use of instruments and experiments is not confined to scientific ways of knowing; it does not indicate a rupture between philosophy and science. Rather, by taking the role of instruments and experiments in knowledge formation seriously, Bachelard - and Canguilhem after him - demonstrate that the philosophy of

³² Ibid., p. 289.

³³ Ibid., pp. 14-15.

³⁴ Ibid., p. 290.

³⁵ Ibid., p. 291.

³⁶ Ibid., p. 290.

³⁷ Foucault (2001), pp. 477 and 480-481. Canguilhem observes, however, that 'there is no philosophical truth'. This does not mean that there is no truth in a specific philosophy or that philosophers are not concerned with the question of truth; it only means that the 'norm' of truth does not apply to philosophy.; ibid., pp. 483-484: 'I cannot say that Kant's philosophy is true, that Nietzsche's is false. There are ridiculous philosophies and rigorous philosophies. I don't know a false philosophy nor, as a consequence, do I know one that is true'. (My translation).

³⁸ Sirinelli (1994), p. 9.

science is about material objects, particularities, and practices rather than about universal truths.³⁹

Canguilhem (1904-1994) studied at the *Lycée Henri IV* in Paris, one of the well-known 'kâgnes' or schools that prepare pupils for the entrance examinations of the *Ecole Normale Supérieure* (ENS). His classmates at the ENS were Jean-Paul Sartre, Raymond Aron, and Paul Nizan, all of whom were destined to become famous twentieth-century philosophers.⁴⁰ After his studies, he taught at *lycées* across the country and - while teaching philosophy in Toulouse - began studying medicine. At the beginning of the Second World War, Canguilhem resigned from his teaching post because - as he said in his resignation letter to the rector of the university - he had 'not passed his exams for the *'agrégation'* in philosophy to teach Labour, Family, Fatherland'.⁴¹ In 1941 he replaced his friend and former fellow student Jean Cavaillès at the University of Strasbourg because the latter became a professor at the Sorbonne in Paris.

Cavaillès was not only a philosopher of mathematics and logic but also a militant activist in the French Resistance. He was executed by the Nazis in 1944 after having twice escaped captivity. His activism inspired Canguilhem personally as well as professionally;⁴² he observed that

[Cavaillès] assigned, twenty years in advance, the task that philosophy is in the process of accepting today - the task of substituting for the primacy of experienced or reflexive consciousness the primacy of concepts, systems, or structures.⁴³

In a memorial address, after Cavaillès' death, Canguilhem drew a polemical distinction between two groups of French philosophers. This distinction would, through its reiteration by Foucault,⁴⁴ become well known in French intellectual circles. Canguilhem said that one group of philosophers focused on the subject and preached activism without practising it. The reference was to the existentialists represented by Sartre who 'militate[d] in [his] writings',⁴⁵ as Sartre himself once said, rather than by taking up arms. The other group, represented by Cavaillès and including Canguilhem, focused on abstract concepts rather

³⁹ Lecourt (1975), p. 164.

⁴⁰ For this biography, I mainly draw on Sirinelli (1994): pp. 464-466 and pp. 595-599 and Macey (1998).

⁴¹ Sirinelli (1994), p. 598-599 (my translation).

⁴² Macey (1998), pp. 176-179.

⁴³ Canguilhem (1994b), pp. 88-89.

⁴⁴ Foucault (1985), p. 4.

⁴⁵ Christofferson (2004), p. 27.

than on the subject but could be found on the battlefields during the war. Canguilhem writes in a tribute to Cavailles:

[A]t the moment, some philosophers are squealing with indignation because certain other philosophers have formed the idea of a philosophy without a personal subject. The philosophical work of Jean Cavailles can be invoked to support that idea. His mathematical philosophy was not constructed with reference to some subject that could momentarily and precariously be identified with Jean Cavailles. That philosophy, from which Jean Cavailles is radically absent, determined a form of action that led him, through the narrow paths of logic, to a pass from which no one returns. Jean Cavailles was the logic of the Resistance lived to the death. Let the philosophers of existence and of the person do as well next time, if they can.⁴⁶

The drawing of such a stark distinction between these groups of philosophers seems slightly out of character for someone who is usually more concerned with demonstrating the impossibility of maintaining rigid distinctions. What perhaps explains Canguilhem's position is that, in this particular case, there simply was no 'middle-ground'. The occupation of France 'profoundly shaped the politics of French intellectuals' in the years after the war and 'the wartime division of friend and enemy, resistor and Nazi, between whom no middle ground was possible, brought intellectuals into a Manichaean world in which refusal to choose sides became a choice for an intolerable status quo.'⁴⁷

While others believe that Cavailles' double life as a professor in the philosophy of logic and as militant activist is inexplicable, Canguilhem observes how Cavailles' activism was a direct consequence of his philosophical beliefs: 'It is a simple deduction ... Nazism was unacceptable insofar as it was the negation - a savage rather than a scientific negation - of universality, and insofar as it portended and sought the end of rational philosophy'.⁴⁸ Canguilhem notes that 'before being the sister of the dream, action must be the daughter of rigor'.⁴⁹

This commitment to 'rigor' also characterizes Canguilhem's style of writing and his image of philosophy as a '*métier*' that requires serious labor, rather than as some fanciful art.⁵⁰ He had little patience for what he regarded as fluffy science and famously observed that many works in psychology give the impression of being a blend of 'a philosophy without rigor, an ethics that makes no demands and a medicine without controls'.⁵¹ It was this apparently paradoxical idea of intellectual rigor culminating in resistance that probably attracted young

⁴⁶ Macey (1998), p. 178; Canguilhem (1996), p. 38.

⁴⁷ Christofferson (2004), p. 27.

⁴⁸ Macey (1998), p. 177; Canguilhem (1996), pp. 36.

⁴⁹ Macey (1998), p. 179; Canguilhem (1996), p. 32.

⁵⁰ Macey (1998), p. 175.

⁵¹ Macey (1998), p. 174; Canguilhem (2002), p. 366.

students in the French university to Canguilhem. As Bourdieu formulated it, Canguilhem did not represent

what is most commonly or frequently found in French philosophy and French universities. On the contrary, what made him a kind of reference point or touchstone for myself and, I think for many others, was his dissonance, not to speak of his resistance. Although holding the apparently most conventional posts within the university system, he was not like the others. Simply, without pretence or sham, with neither complacency nor pomposity, he fully fulfilled his function as a professor, as a professor of philosophy (he never played the philosopher).⁵²

Although he was popular among students, Canguilhem did not position himself with regard to the student protests in 1968. His sympathy for these protests has, therefore, become the subject of some speculation. There are some who believe that he sympathized with - or at least understood - the protesters,⁵³ while others believe that he found it difficult to come to terms with the protests.⁵⁴ Foucault said in this regard:

[T]here were also people who did not follow [this] movement. I am thinking of those who were interested in the history of science ... Particularly around Canguilhem, an extremely influential figure in the French University - the young French University. Many of his students were neither Marxists, nor Freudians, nor structuralists. And here I am speaking of myself.⁵⁵

Although some Marxist influences have been read into his work by Lecourt,⁵⁶ Canguilhem never explicitly aligned himself with Marxism or communism and even argued against it on specific issues in much the same way as Foucault did. The petitions that Canguilhem signed while he was still at the *Ecole Normale Supérieure* (ENS) show that his sympathies were with the 'traditional or liberal left, but not the revolutionary left' to which many of his students belonged.⁵⁷ Canguilhem probably organized, for example, the petition against the *Loi Paul Boncour*; a law that was meant to prepare the country for wartime but was regarded as stifling intellectual freedom.⁵⁸

As a student, Canguilhem was a pacifist, as many intellectuals were during the interwar period.⁵⁹ Together with Sartre and other students he protested against mandatory military

⁵² Bourdieu (1998), p. 190.

⁵³ Dagognet (1997), p. 11.

⁵⁴ Bourdieu (1998), p. 191; Macey (1998), p. 173.

⁵⁵ Gutting (1989), citing Foucault at p. 11.

⁵⁶ Lecourt (1975).

⁵⁷ Macey (1998), p. 173.

⁵⁸ Sirinelli (1995), p. 326 and 465.

⁵⁹ Ibid., Ch. 10, pp. 314-343; See ibid., Ch.13, pp. 427-496, on the influence of Canguilhem's teacher Alain who was a pacifist.

training at the ENS.⁶⁰ He gave up pacifism and joined the French Resistance,⁶¹ after the Gestapo entered the University of Strasbourg where he was teaching and deported two professors and a number of students. Canguilhem left the university to operate a field hospital for the Resistance in the mountains of Auvergne and received, after the war ended, the *Croix de guerre* and the *Croix de la Resistance* for evacuating that hospital under fire. He returned in 1945 to the University of Strasbourg and, ten years later, succeeded the famous French philosopher of science Bachelard (who had supervised Canguilhem's thesis in philosophy) as Professor of the History and Philosophy of Sciences at the Sorbonne.

1.2.2 Canguilhem's 'vita contemplativa'

Canguilhem published both his thesis in medicine, *Le normal et le pathologique*,⁶² and his thesis in philosophy, *La Formation du concept du reflexe aux XVII et XVIII siècles*,⁶³ as well as a book that he wrote together with a fellow lecturer while he was teaching in Toulouse entitled *Traité de logique et de morale*.⁶⁴ Canguilhem's other books, *La connaissance de la vie*,⁶⁵ *Etudes d'histoire et de philosophie des sciences*,⁶⁶ and *Idéologie et rationalité dans l'histoire des sciences de la vie*,⁶⁷ are collections of essays that had previously been published in a variety of French journals or that were delivered by Canguilhem as lectures. His writings have been grouped together in different ways by different commentators; some group these writings by theme⁶⁸ while others distinguish consecutive phases in his writing.⁶⁹

There are several books that are exclusively dedicated to Canguilhem's thought. Some of these are monographs, such as *Canguilhem et les normes*⁷⁰ which focuses - as the title

⁶⁰ Ibid., pp. 326-328. Canguilhem wrote two songs for the end-of-year revue at the ENS (one together with Sartre) against the *Loi Paul Boncour* (about the use of intellectuals in wartime) and against mandatory military training.

⁶¹ Ibid., pp. 597-598; See Canguilhem & Planet (1939), pp. 297-299, on the necessity of choosing 'between an attitude of submission to historical contingencies or necessities, that we believe are metaphysically or physically founded, and an attitude of resistance or rather organization.' (My translation). Canguilhem apparently decided to choose the latter: 'that which we call peace remains a purely verbal negation of war.'

⁶² Canguilhem (2006).

⁶³ Canguilhem (1977).

⁶⁴ Canguilhem and Planet (1939).

⁶⁵ Canguilhem (1993).

⁶⁶ Canguilhem (2002).

⁶⁷ Canguilhem (2000).

⁶⁸ Gayon (1998).

⁶⁹ Dagognet (1985).

⁷⁰ LeBlanc (1998).

suggests - on his idea of norms and *Georges Canguilhem: philosophe de la vie*⁷¹ which takes a more holistic approach to his work. Other books are collections of papers presented at conferences dedicated to Canguilhem's thought, such as *Actualité de Georges Canguilhem - le normal et le pathologique*⁷² which focuses on his thesis in medicine and *Georges Canguilhem: historien, philosophe des sciences*⁷³ which addresses various aspects of his thought. Special editions of journals have been dedicated to Canguilhem, such as an issue of the *Revue de métaphysique et de morale*,⁷⁴ the famous French philosophy journal in which Canguilhem himself frequently published. This issue is introduced by Foucault and collects articles by former students on Canguilhem's work, personality, and teaching style. The journal *Economy & Society*⁷⁵ devoted a special issue to his thought and collects papers from a conference held on Canguilhem's work in London.

A few books have been written on the epistemological lineage of Bachelard, Canguilhem and Foucault, and Bachelard and Canguilhem respectively.⁷⁶ Apart from this, there are various articles, contributions to books, and book reviews that have been written about Canguilhem's work.⁷⁷ Much of his work has not been translated into English, although translations have been published of *Le normal et le pathologique* and *Idéologie et rationalité dans l'histoire des sciences de la vie*.⁷⁸ A book has also been published in English that collects various fragments from Canguilhem's essays and groups these together into various themes.⁷⁹ However, by taking such fragments out of context it becomes almost impossible to appreciate Canguilhem's particular style of writing and the substance of his ideas.

⁷¹ Dagognet (1997).

⁷² Bing, Braunstein, Roudinesco (Eds.) (1998).

⁷³ Balibar, Cardot, Duroux (Eds.) (1993).

⁷⁴ *Revue de métaphysique et de morale* 90 :1 (1985).

⁷⁵ *Economy & Society* 27: 2&3 (1998).

⁷⁶ Lecourt (1975); Hertogh (1986). See also Gutting (1989), pp. 9-54.

⁷⁷ Most notably: Hacking (1998); Rheinberger (2005b).

⁷⁸ By Reidel (1978) and MIT Press (1988), respectively.

⁷⁹ Canguilhem (1994a). See the extensive bibliography by C. Limoges of Canguilhem's work (including essays he wrote as a student).

1.3 Intellectual lineage

1.3.1 Canguilhem as 'precursor' to Foucault

Some efforts have been made to establish the relevance of Canguilhem's writing for sociological inquiries into the life sciences and for an Anglo-American audience.⁸⁰ However, I argue that such efforts have - at least in some respects - been counterproductive. Initial interest in Canguilhem's work often follows from his role as mentor of Foucault. Most commentators seem to adhere to the idea of a linear and progressive history of thought that can only be charted by reference to consecutive individual thinkers. Canguilhem makes a point of rejecting the idea of the progress of knowledge and the associated method of focusing on individuals and their theories.⁸¹ He believes that the idea of the 'precursor' defeats the purpose of a history of science because the historicity of the sciences themselves is not recognized.⁸²

The intellectual complicity between Canguilhem and Foucault is obvious. To read the work of one through the work of the other may, therefore, be productive for certain purposes. However, I argue that to read Canguilhem exclusively through Foucault and attribute value to his work only to the extent that Foucault elaborates on it 'dilutes' Canguilhem's thought. The potential of his work remains unrecognized by those who read it in order to make further sense of Foucault, rather than appreciate it on its own merit. Canguilhem's work is often described as too 'organic' or as being exclusively concerned with the life sciences;⁸³ as if it has nothing to contribute to the social sciences without Foucault's elaboration.

In what follows, the substance of Canguilhem's ideas is sometimes briefly contrasted with the work of Luhmann. Luhmann's social systems may seem far removed from the living processes that form the object of inquiry for Canguilhem. However, I argue that Canguilhem and Luhmann draw - to some extent - on the same intellectual heritage. Both were influenced by the German philosophers Kant, Hegel, and Nietzsche and by the

⁸⁰ N. Rose (1998); Gutting (1989) pp. 32-52.

⁸¹ Canguilhem (1998), p. 318, observes that Kant adhered to the progress theory of the *Aufklärung*, even if his own Copernican Revolution arguably disrupted such a linear idea of progress.

⁸² See Canguilhem (2002), pp. 20-23 on the 'precursor'; *ibid.*, p. 21: 'The complacency of researching, finding, and celebrating precursors is the most distinct symptom of an inaptitude for epistemological critique.' (My translation).

⁸³ N. Rose (1998), pp. 162 and 164.

twentieth century theories of cybernetics and autopoiesis.⁸⁴ More importantly, I argue that Canguilhem and Luhmann share a common purpose even if their respective styles are very different and their ideas unfold in different environments. Both engage with and seek to question, through different theoretical methods, the particular rationality that was formulated in the German philosophical tradition - especially by Kant.

Luhmann's systems theory represents a challenge to Kant's theory of understanding, while at the same time remaining inextricably linked to it. Canguilhem's inquiry into concepts can be regarded as preceding Luhmann's transformation of the terms that were previously associated with 'the social'. Luhmann refers to Canguilhem's work in specific instances, most notably with reference to the concept of 'environment' (see Chapter 3). However, Canguilhem makes no explicit reference to Luhmann so that it cannot be assumed that he was aware or familiar with his work.

1.3.2 Countrymen: mentors and pupils

Canguilhem's work is influenced by various writings in biology, medicine, and philosophy. One would perhaps - taking into account their shared subject matter - expect Bergson, who is often described as the 'philosopher of life', to represent the most important influence on his thought. However, Bergson's philosophy and his interest in the life sciences differs from that of Canguilhem. Bergson, for example, questions specific aspects of Kant's theory of understanding - most notably his ideas of space and time - in relation to living processes. However, Canguilhem questions the wider project of Enlightenment rationality by focusing on the relation between knowledge and life.⁸⁵

A philosopher that arguably influenced Canguilhem's work much more, and whom he writes about from an early age, is Comte.⁸⁶ Comte's contributions to the philosophy of biology, for which he is not specifically known, are explored by Canguilhem as well as his

⁸⁴ Canguilhem (2002), p. 348, focusing on the original inspiration for autopoietic theory - i.e. Kant's ideas on the self-organization of living processes - by reference to the 'self-containment of organizational operations' (my translation); Canguilhem (2000), p. 82, referring to cybernetics in his discussion on regulation in biology.

⁸⁵ Canguilhem (2002), p. 348 : Canguilhem's philosophy is one of concepts. He observes about Bergson's notion of '*durée*' in relation to living processes: 'It is clear that a philosophy of life thus conceived cannot be a philosophy of the concept.' (My translation)

⁸⁶ Canguilhem (2002), pp. 61-98; Macey (1998), p. 174: Canguilhem submitted an essay for entrance to the '*agrégation*' in 1926 on Comte's theory of order and progress.

ideas on progress. Canguilhem finds in Comte's work many of the main themes that he addresses in biology and in the history and philosophy of science.

However, the philosopher who undoubtedly exercised the greatest influence on Canguilhem was Bachelard. He first recovered the concept of the norm for the sciences. Canguilhem takes this concept in an entirely different direction by elaborating the notion of 'normativity' in the life sciences (see Chapter 6). Bachelard discusses the idea of 'epistemological value' mainly by reference to physics and mathematics.⁸⁷ This idea, as Lecourt points out, is directed against two notions that dominated philosophy at the time.

First, it is directed against the idea that the notion of value is the exclusive domain of ethics. Bachelard claims that it is in fact epistemology and the philosophy of science where the question of value and normativity should be addressed, because - according to him - the most important value, i.e. truth, is the privileged subject of the sciences.⁸⁸ Second, his idea of epistemological value challenges a predominantly positivist philosophy of science. Science, according to Bachelard, should not be regarded as delivering facts about the world but as the continuous emergence of a variety of epistemological values. The idea of 'epistemological value' was inspired by Spinoza's saying "“*veritas norma sui*” (the truth is its own measure)".⁸⁹

This does not mean that science describes certain truths about - or prescribes certain laws to - the world but that the sciences are distinguished by the way in which they give rise to different truths. This, in turn, gives rise to a continuous process of correction and rectification and leads to the idea that what lies at the heart of the sciences is not so much truth but error (see Chapter 5, para. 3.2.3).⁹⁰ It is this focus on the generation of truths, on the importance of norms, and on the centrality of error that is subsequently taken up by Canguilhem.

Canguilhem was also inspired by Bachelard's emphasis on the role that instruments and experiments play in the generation of knowledge.⁹¹ Bachelard proposes that the generation of knowledge does not take place in a vacuum or in someone's mind (as Kant seemingly

⁸⁷ Lecourt (1975), pp. 10-11.

⁸⁸ See N. Rose (1998), p. 160 on scientific discourse as 'veridical'.

⁸⁹ Lecourt (1975), p. 12.

⁹⁰ Ibid., pp. 54-55.

⁹¹ Ibid, p. 76: Bachelard refers to scientific instruments as 'materialized theories' and invented the notion of 'phenomeno-technics' (on the latter notion, see Rheinberger (2005a)). Ibid., p. 137: traditional philosophy could only regard the role of instruments in concept formation as 'inessential "mediation"'.

suggested). Rather, it is mediated and constituted through a material world and through the instruments that are used to obtain knowledge. He does not believe in a 'tranquil universe of the ideal problems posed by the philosopher about "science"',⁹² but instead believes that the focus of the philosopher should be on the real problems that confront researchers and the historical conditions of the production of scientific knowledge. He does not inquire into the question of knowledge or understanding as such but into the particular kinds of knowledge generated by particular problems.

Not only is Canguilhem influenced by his mentor Bachelard, but also by the work of his former students; especially Foucault whose thesis he examined.⁹³ He refers at times to the work of Simondon, Dagognet, and Lecourt, all of whom elaborate various themes of Canguilhem's own work. Foucault focuses on the relation between normativity and life through his notion of 'biopower'.⁹⁴ Simondon develops his ideas on individuation in the sciences and on the relation between biology and technology.⁹⁵ Dagognet's work remains perhaps most closely to Canguilhem's specific fields of inquiry: epistemology, reason, and the life sciences.⁹⁶ Lecourt focuses especially on Canguilhem's epistemology.⁹⁷

However, Canguilhem was not only concerned with philosophy. He followed Bachelard's advice of learning from the sciences and using these sciences to inquire into philosophical concepts.⁹⁸ In the same way as Comte performs the role of one of Canguilhem's - often invisible - philosophical interlocutors, the famous French physiologist Claude Bernard is his sounding board in matters of biology and medicine (as well as philosophy). These different disciplines can never be clearly distinguished in Canguilhem's work. He notes, for example, in the introduction to his thesis in medicine that he has ceded perhaps a little too much to the '*démon philosophique*'.⁹⁹ The impossibility of distinguishing between the sciences and philosophy is partly the result of his Bachelardian way of philosophizing. It implies that philosophy cannot merely accept the end result of scientific explorations as object of inquiry. Rather, philosophy needs to probe the different avenues of scientific

⁹² Ibid., p. 26.

⁹³ See Canguilhem (1995) for his original comments on Foucault's thesis; Canguilhem (2000), p. 10: for Canguilhem's engagement with, and criticism of, Foucault's work in *L'Archéologie du Savoir*; Canguilhem (1984) co-edited a book on Dagognet.

⁹⁴ Foucault (1998), pp. 135-145.

⁹⁵ Simondon (1964) and (1958).

⁹⁶ For example, Dagognet (1984) and (1988).

⁹⁷ Lecourt (1975).

⁹⁸ Ibid., p. 34. Bachelard calls this: '*Se mettre à l'école des sciences*.'

⁹⁹ Canguilhem (2006), p. 5 (Introduction to the 2nd edition).

practices and experiments in order to follow the formation of objects or concepts and determine their meaning and value.¹⁰⁰

The main reason why Canguilhem was fascinated by Bernard was not simply because he was one of the most influential figures in the French life sciences, as Comte was in French philosophy, but because Bernard's work contains a number of productive ambiguities. Although Bernard often professes his antagonism towards philosophy and history, he himself is prone to philosophical musings; hence Canguilhem's description of him as a scientist 'in love with philosophizing' (*'fêru de philosophèmes'*).¹⁰¹ One of the ambiguities of Bernard's work arises from the fact that his declared aversion to what he regards as the loftiness of philosophical inquiries and the uselessness of historical inquiries into the sciences¹⁰² is paralleled by his use of philosophical and historical reflection. This enables him to develop a theory of experimental medicine that seeks to set the agenda of medical research for years to come.¹⁰³

1.3.3 The German connection: scientists and philosophers

Canguilhem himself points to another, perhaps more unexpected, influence on his thought: the works of various German philosophers and scientists. Canguilhem observes that French philosophers, probably to their detriment, have not engaged much with the ideas of certain German philosophers.¹⁰⁴ He makes an exception for Cavaillès whom he describes in an obituary as despising Nazism but as having a great passion for 'the Germany of Kant and Beethoven' (despite the fact that the defence of German 'Kultur' was used as justification for the war).¹⁰⁵ Many French philosophers of the interwar period, including Sartre and Aron, spent one or two years at German universities;¹⁰⁶ Cavaillès retained an interest in German philosophy from his studies in Heidelberg. However, it was (arguably) Kojève's presentation of Hegel that gave German philosophy a more permanent place in French philosophical thinking.¹⁰⁷

¹⁰⁰ Canguilhem (2003), p. 165.

¹⁰¹ Canguilhem (1988), p. xi; Canguilhem (2000), p. 10.

¹⁰² See Petit (1987) for some of Bernard's contemptuous quotes.

¹⁰³ Ibid. and Bernard (1865).

¹⁰⁴ Canguilhem (2002), p. 347, mentioning the example of a philosophy of the organic à la Hegel. See Fichant (1993), p. 41 for the influence on Canguilhem of German philosophy.

¹⁰⁵ Ferrières (1982), p. 202: Cavaillès said, under interrogation, how much his philosophy was influenced by German philosophers and how he appreciated the Germany of Kant and Beethoven.

¹⁰⁶ Judt (1992), p. 76.

¹⁰⁷ Ibid.

Canguilhem makes reference to Kant, Hegel, and Nietzsche, but he refers to each in a quite different way. His most elaborate reference to Kant is with regard to the relation between the concept and life. He explicitly refers to Kant's *Critique of Pure Reason* in order to shed light on the character of concepts and to the *Critique of Judgment* in order to explore the relation between knowledge and the self-organization of living processes.¹⁰⁸ At other times, Canguilhem refers only briefly to Kant's *Critique of Pure Reason* in order to clarify his own thoughts without engaging much with its contents.¹⁰⁹ In only a limited number of paragraphs does Canguilhem refer explicitly to the limitations of Kant's ideas on knowledge and understanding with regard to living processes.¹¹⁰

Some of Canguilhem's most explicit references to Hegel are also with regard to the relation between knowledge and life. They demonstrate his belief that his own ideas on the subject most closely resemble Hegel's views, rather than those of Kant or Bergson.¹¹¹ However, references to Hegel are specific and piecemeal and do not seem to form part of any sustained engagement with Hegel's philosophy.¹¹²

Canguilhem's engagement with Nietzsche is even more difficult to define.¹¹³ The influence of Nietzsche on his work is more obvious than that of either Kant or Hegel, although explicit references to Nietzsche are few and far between.¹¹⁴ It seems curious, as Stiegler points out, that Canguilhem - when he does refer to Nietzsche - seems to slightly misrepresent the latter's arguments in order to contrast his own views with it.¹¹⁵ Nevertheless, some specific thoughts of Nietzsche resonate quite clearly in Canguilhem's work (see Chapters 4 and 6).

Canguilhem's method of tracing concepts rather than individual protagonists forces him to engage with thinkers of different philosophical backgrounds. It is the intricacies of the

¹⁰⁸ Canguilhem (2002), pp. 343-345.

¹⁰⁹ Canguilhem (2006), p. 175.

¹¹⁰ Canguilhem (2002), pp. 351-352.

¹¹¹ Ibid., pp. 345-348.

¹¹² Gayon (1998), p. 323, n. 79, points out that Canguilhem's references to Hegel seem to be inaccurate and that Canguilhem, while 'borrowing' some of Hegel's expressions, does not use Hegel's philosophy to any great extent.

¹¹³ Foucault (1985), p. 14 observes that Canguilhem was at the same time close to - and removed from - Nietzsche. Canguilhem described himself once as '*un nietzschéen sans cartes*' Fichant (1993), p. 48 n. 4.

¹¹⁴ See Stiegler (2001) for references by Canguilhem to Nietzsche's work; Fichant (1993), pp. 44-45 on Canguilhem's engagement with Nietzsche's philosophy.

¹¹⁵ Stiegler (2001), pp. 85-88: an example is the suggestion that Nietzsche follows Bernard's argument about the homogeneity of the normal and pathological; Canguilhem (2006), p. 16.

paths of concepts that make it impossible to draw geographical lines between French and German philosophical traditions. However, Canguilhem does note a substantial difference between German and French writing on the life sciences specifically. He says that, whereas the Germans rationalize the means (*'moyens'*) of life, the French do the same to its ends (*'fins'*).¹¹⁶ In other words, whereas the former accept the indeterminacy of the *'fins'* of living processes, they cannot come to terms with the indeterminacy of the functioning of living processes without rationalizing such functioning. The French, in turn, need to know where living processes are going or what their particular purpose is while they happily leave the functioning of such processes to intuition.

This comment seemingly refers to the particular style of thought of two philosophical traditions. At the same time, the distinction between 'means' and 'ends' is put into question by living processes themselves and by their technological manipulation. Kant characterized organisms as processes of self-generation where means and ends - or cause and effect - become almost indistinguishable: 'with regard to its *species* the tree produces itself ... it is both cause and effect, both generating itself and being generated by itself ceaselessly'.¹¹⁷ In Kant's work on morality, the distinction between means and ends takes on a slightly different significance through its association with the moral status of persons and things.¹¹⁸ The relation between means and ends in the life sciences is an important question that will not be addressed here in much further detail.

Apart from the work of German philosophers, the ideas of Goldstein - a neurologist - exercised great influence on Canguilhem's work. Goldstein fled Germany before the war in fear of persecution, wrote his book *Der Aufbau des Organismus*¹¹⁹ in exile in The Netherlands, and subsequently emigrated to the United States where he became a professor at Columbia University. Two aspects of his method, both counterintuitive at the time, particularly inspired Canguilhem. First, Goldstein starts his inquiry into the organism by regarding it as a whole rather than by dissecting it into parts.¹²⁰ Second, Goldstein's study is based on 'pathological data' that he had obtained while treating soldiers who suffered

¹¹⁶ Canguilhem (1947), pp. 325-326.

¹¹⁷ Kant (1987), p. 249, section 64, para. 370.

¹¹⁸ Kant (2004), p. 37, 4:428: 'Beings the existence of which rests not on our will but on nature, if they are beings without reason, still have only a relative worth, as means, and are therefore called *things*, whereas rational beings are called *persons* because their nature already marks them out as an end in itself, that is, as something that may not be used merely as a means.'

¹¹⁹ Goldstein (1995).

¹²⁰ *Ibid.*, pp. 18 and 23-24.

brain damage during the First World War.¹²¹ Canguilhem follows Goldstein's focus on normality and pathology and on the individual in his own writing. Canguilhem and his wife Simone translated some of Goldstein's work on epistemology from English into French.¹²²

PART II

2.1 A methodology not limited to method

2.1.1 *The characteristics of concepts*

The focus on concepts in Canguilhem's work, and in the following chapters, requires some explanation or perhaps justification. Conceptual inquiry seems to be somewhat unfashionable. Canguilhem notes in an introduction to one of his books that it is up to the reader to decide whether he should be regarded as a '*fossile conceptualiste*'.¹²³ Many inquiries focus predominantly on the material world of objects and instruments. A focus on concepts only seems justifiable when the role played by instruments and experiments in the formation of such concepts is emphasized. As Bachelard observes: 'a concept must from now on integrate into its constitution as a concept the technical conditions of its realization'.¹²⁴

The idea that concepts are products of practices and of the material environment in which they are put to use, represents an alternative to Kant's idea that a concept is primarily a tool of cognition that should necessarily be prior to the world that it seeks to make intelligible. One of the consequences of the idea that the 'construction' of concepts is 'intertwined with the practices which operationalize them, give them empirical reference, and make them function as tools for the production of knowledge'¹²⁵ is that concepts are indeterminate. This does not mean that they become useless as tools of cognition; quite the opposite: it makes them more useful because their 'reference potential'¹²⁶ is greater.

¹²¹ Ibid., pp. 29-30; *ibid.*, p. 15.

¹²² Canguilhem (1994a), see Limoges' bibliography, pp. 385-454, p. 407.

¹²³ Canguilhem (2000), p. 9.

¹²⁴ Lecourt (1975), p. 138.

¹²⁵ Lenoir (1988); Rheinberger (1997a), pp. 16-17.

¹²⁶ Kitcher (1982), p. 340.

Indeterminacy plays an important role in Bachelard's philosophy; such indeterminacy inspired subsequent references to, for example, 'concepts in flux' and 'boundary concepts'.¹²⁷ Canguilhem, following Bachelard, focuses not only on the emergence of concepts and their characteristics but also on the continuous rectification and transformation of concepts. Such rectification is regarded by him primarily as the result of experimentation rather than logical reasoning or the progressive development of knowledge.¹²⁸

Another characteristic of concepts is their 'mobility' or the way in which concepts tend to hover between practice and theory.¹²⁹ This notion of the mobility of concepts differs from the traditional idea of the correspondence between a concept and the object it refers to. The mobility of concepts expresses a productive tension between thought and practice,¹³⁰ whereas the idea of correspondence relies on a separation between the empirical world and understanding. The representation of concepts as 'mobile' also differs from the idea that concepts migrate between disciplines or circulate freely irrespective of disciplinary boundaries.

The characteristics of concepts - their indeterminacy, the way in which they implicate the means of their own production, and their mobility - are well documented. However, concepts are still largely regarded in the Kantian sense as making objects possible; perhaps not as objects themselves but as objects of understanding or knowledge.¹³¹ Instruments are regarded as playing a significant role in concept formation, while concepts themselves are regarded as instruments or tools that are necessary for the formation of knowledge.¹³²

¹²⁷ Dagognet (1965), p. 83: Bachelard said 'We must insist on the necessity of reinstituting the "awareness of the non-rigorous" in order for a complete "awareness of rigor" to be possible.' (My translation); Rheinberger (1997a), p. 14: terms attributed to Elkana and Löwy respectively; Rheinberger (2000), p. 219: on the usefulness of 'an epistemology of the imprecise'; Tiles (2005).

¹²⁸ Canguilhem (2002), pp. 295-296: 'The nineteenth century did not *invent* the concept of reflex, but it *rectified* it. This rectification of the concept is not a thing of logic, it is a thing of experiment ... This rectification is, therefore, not linear, it is made up of polemical situations that do not all represent progress.' (My translation).

¹²⁹ Rheinberger (1997a), p. 13.

¹³⁰ Ibid., concepts shuttle back and forth between deriving an idea from practice and imposing one upon it.

¹³¹ Ibid., p. 22: 'What is at stake is the grand project of modernity, the instantiation of Kant's rationalist credo that we understand only what we can make in terms of our conceptualizations ... Meanwhile, the credo has taken on a very non-Kantian appearance. What we can ourselves make and accomplish, we always know in the form in which we locally do it, and not even this completely.'

¹³² Canguilhem (2002), p. 353: 'the human invention of the concept ... goes hand in hand with the human invention of the tool'.

Canguilhem does not deny that a concept is, in many ways, an instrument that has cognitive value to the extent that it functions as an ‘operator’ in the formation of knowledge.¹³³ However, he chooses to focus on the values that a concept integrates in its form. This requires him to investigate the conditions under which a concept emerged. This particular method of inquiry contributes to the greater project, inspired by Bachelard, of revealing the normative in scientific discourse.¹³⁴

The focus on concepts in the following chapters is not necessarily motivated by a desire to follow Canguilhem’s own method. Whereas Canguilhem charts the transformation of concepts through time and in different contexts, concepts are used here in order to show how Canguilhem engages with modern rationality through some of its most basic epistemological forms. While Canguilhem focuses on very specific concepts, the focus here is on some of the ‘second order’ concepts that underlie Canguilhem’s inquiries and allow him to structure his thought. As a consequence, I do not explore how such concepts may have been produced or transformed through certain practices, instruments, and experiments.

2.1.2 *Acting through concepts or concepts as actors?*

What role does Canguilhem fulfil in the following chapters; who or what does Canguilhem represent? He could be regarded as a centre of reference in which various ideas, concepts, and traditions can be ‘anchored’.¹³⁵ More particularly, Canguilhem can perhaps be associated with the figure of the ‘*médecin-philosophe*’ that emerged in Europe around the middle of the eighteenth century. The ‘*médecin-philosophe*’ originated with the ‘Montpellier school’ in France, most notably represented by the famous physiologist Bichat.¹³⁶ It represented a school of thought whose most distinctive characteristic was a belief that medicine provides privileged entry into key philosophical issues.

Canguilhem could also be identified with the persona of the ‘intellectual’. The emergence of this persona is often attributed to the end of the nineteenth century and the Dreyfuss affair but has also been associated with the interwar period when writers developed a

¹³³ Ibid., p. 360.

¹³⁴ This does not mean that scientific discourse therefore becomes unscientific or unreasonable. On the contrary, reason itself is shown to be normative. See also N. Rose (1998), p. 159.

¹³⁵ Hunter (2007), p. 583.

¹³⁶ Zammito (2008).

collective voice that was strongly influenced by pacifism.¹³⁷ The intellectual emerged when writers and philosophers no longer expressed their opinions solely as representatives of their respective professions.

It seems as if the idea of the intellectual was ready for renewal almost from the time it emerged. Both Sartre and Foucault (the latter together with his philosophical accomplice Deleuze)¹³⁸ sought to redefine the notion of the intellectual in the 1960s.¹³⁹ The reason for this redefinition was partly the dissatisfaction to which the unfulfilled promise of the intellectual as a moral arbiter and representative of the people gave rise. Foucault observes that '[f]or the most part, I think that intellectuals have given up trying to be prophets - that's if intellectuals still exist as a category, or should still exist, which isn't certain or even perhaps desirable'.¹⁴⁰ Deleuze formulates their project of redefining the intellectual as follows:

[F]or us the theorizing intellectual has ceased to be a subject, a representing or representative consciousness. Those who act and who struggle have ceased to be represented, be it by a party or union that unrightfully claims in turn the right to be their consciousness. Who speaks and who acts? It is always a multiplicity, even in the person who speaks and acts ... There is no more representation. There is only action, the action of theory and the action of practice in relay relations or in networks.¹⁴¹

The 'refusal of representation'¹⁴² and the emphasis on the 'action of theory' is reminiscent of Canguilhem's ideas that the subject should not be taken as the point of departure and that conceptual rigour inevitably leads to action. The action that Canguilhem, as well as Foucault and Deleuze, refer to can no longer be referred back to - or exclusively identified with - a particular individual or subject. Rather, it follows from concepts that together form - in Deleuze's words - a kind of intellectual 'multiplicity'. Canguilhem addresses the correspondence between action and theory when he emphasizes that Cavaillès' activism cannot solely be referred back to Cavaillès as a subject. Rather, action is associated with the 'narrow paths of logic' and Cavaillès' conceptual inquiry (see para. 1.2.1 above). This suggests that concepts represent more than just a methodology for Canguilhem.

¹³⁷ Levy (1995), p. 55; Sirinelli (1988).

¹³⁸ Pottage (1998b), p. 2, refers to 'a sort of ongoing conceptual complicity between Foucault and Deleuze'. See also Davidson (1997).

¹³⁹ Christofferson (2004), pp. 70-71: Sartre talked about the 'new intellectual', while Foucault and Deleuze referred to the 'specific intellectual'. Gutting (2005a): The latter was represented by the teacher or the engineer rather than by the intellectual who 'speak[s] in the capacity of master of truth and justice.'

¹⁴⁰ Levy (1995), p. 372.

¹⁴¹ Christofferson (2004), p. 71.

¹⁴² Ibid.

In what follows, the focus is not on Canguilhem as a philosopher or intellectual; as a subject who acts through concepts. Rather, concepts are themselves regarded as actors. Together, they form an 'intellectual multiplicity' that is not reducible to - or exclusively representative of - the individual that is Georges Canguilhem. The concepts that he addressed do not refer back to Canguilhem - the subject, but to other concepts. As Deleuze observes:

In any concept there are usually bits or components that come from other concepts, which corresponded to other problems and presupposed other planes ... In fact, having a finite number of components, every concept will branch off toward other concepts that are differently composed but that constitute other regions of the same plane, answer to problems that can be connected to each other, and participate in a co-creation.¹⁴³

Since concepts refer to themselves and to other concepts, they are at the same time absolute and relative. They are relative with regard to other concepts but absolute with reference to the situation in which they emerge and the values they envelop.¹⁴⁴ The reference of concepts to other concepts implies that concepts 'extend to infinity'.¹⁴⁵ This is why Canguilhem is often regarded as tracing networks of concepts that seem to extend endlessly beyond any theory or individual.

The idea of the self-reference of concepts, and of the reference of concepts to other concepts, was also present in Kant's work. He emphasized that concepts are tools of understanding that do not, in and of themselves, claim anything regarding the world of experience. This raises, at the same time, the difficulty of the distinction between understanding and experience. One of the main questions for Kant was how concepts can correspond with experience without deriving from it (see Chapter 2).

2.1.3 The vitality of concepts

Canguilhem's method of divorcing concepts from theories makes it possible for concepts to become actors. Whereas theories are necessarily associated with an individual thinker, concepts extend beyond the theory as well as the individual. Theories are elaborated around concepts and, therefore, appear only 'after the event'.¹⁴⁶ The focus on concepts rather than

¹⁴³ Deleuze & Guattari (1994), p. 18.

¹⁴⁴ Ibid., p. 21.

¹⁴⁵ Ibid., p. 19.

¹⁴⁶ Lecourt (1975), p. 173.

theories represents the greatest difference between Canguilhem's work and Anglo-American philosophy of science. As Gutting observes:

[A]s long as concepts are regarded as functions of theories, their history will be identical with that of the development of theoretical formulations. But for Canguilhem concepts are 'theoretically polyvalent'; the same concept can function in quite different theoretical contexts. This opens up the possibility of histories of concepts that are distinct from the standard histories that merely trace a succession of theoretical formulations.¹⁴⁷

Canguilhem's method has influenced many writers who 'do not propose, advocate, or refute theories of knowledge. They study epistemological concepts as objects that evolve and mutate.'¹⁴⁸ This vitality of concepts - their evolution, mutation, and self-generation - is expressed in Canguilhem's idea that concepts are life forms and that the processes of knowing and living are intimately linked (see Chapter 5). It represents a challenge to the traditional separation between knowledge and life that characterizes Kant's theory of understanding.

Deleuze explored the vitality of concepts further when he referred to the process of autopoiesis in relation to the formation of concepts:

But the concept is not given, it is created; it is to be created. It is not formed but posits itself in itself - it is a self-positing ('*auto-position*'). Creation and self-positing mutually imply each other because what is truly created, from the living being to the work of art, thereby enjoys a self-positing of itself, or an autopoietic ('*autopoiétique*') characteristic by which it is recognized.¹⁴⁹

The idea that concepts are in some sense self-generative implies that they are creative or productive, rather than mere instruments or fabrications of knowledge. Deleuze observes that the formation of concepts does not cease after their initial emergence but that such formation is a continuing process: 'although concepts are dated, signed, and baptized, they have their own way of not dying while remaining subject to constraints of renewal, replacement, and mutation.'¹⁵⁰ This statement echoes Canguilhem's view that a concept never remains the same in different times and contexts, even though the problem it envelops may persist throughout time. It is always a particular situation or question that gives rise to a concept and that this concept, in turn, formulates. This is why a concept is always normative; there is no such thing as an 'innocent' or neutral concept.¹⁵¹

¹⁴⁷ Gutting (2005c), p. 8.

¹⁴⁸ Hacking (2002), p. 9.

¹⁴⁹ Deleuze & Guattari (1994), p. 11 ; Deleuze & Guattari (1991), p. 16.

¹⁵⁰ Ibid., p. 8.

¹⁵¹ Duroux (1993), p. 49, observing that what he learned from Canguilhem was the '*non-innocence des concepts*'.

2.1.4 Concepts as problems

Canguilhem's tracing of concepts is often described as one of the defining characteristics of his work. However, this work should not be read as a mere history of ideas that describes concepts and their formulations over time. I argue that Canguilhem uses concepts, the tools of modern rationality,¹⁵² in order to question this rationality. The concepts to be discussed perform two main functions in order to perform this task. First, they envelop problems - and second - they diversify, rather than unify, the values and intuitions that they integrate.

Canguilhem does not focus much on the pragmatic character of a concept 'as a process to economize thought'.¹⁵³ Rather, it is the inherently problematic nature of a concept that makes a concept productive. In other words, Canguilhem uses concepts because they 'preserve a problem',¹⁵⁴ not because they exclusively make knowledge possible - as Kant proposed. As Heidegger observes:

[B]y the retrieval of a basic problem, we understand the opening-up of its original, long-concealed possibilities, through the working-out of which it is transformed. In this way it first comes to be preserved in its capacity as a problem. To preserve a problem, however, means to free and keep watch over those inner forces which make it possible ... as a problem.¹⁵⁵

This does not mean that a problem is preserved in a concept and, therefore, remains identical through time. Concepts change according to how a problem is transformed and reformulated over time. Lecourt observes that Canguilhem not only focuses on the preservation of problems but also on the 'conditions of *appearance* of concepts, i.e., ultimately on the conditions which make problems *formulatable*.'¹⁵⁶ This means that when Canguilhem 'traces' a particular concept, he does not explore how something is known through that concept. Rather, he investigates what that concept envelops or integrates within itself; a diversity of problems, values, and intuitions.

¹⁵² Canguilhem (2002), p. 344: Canguilhem argues that Kant regards the concept primarily as a necessity of reason.

¹⁵³ Ibid.

¹⁵⁴ Canguilhem (1978), p. xxv: Canguilhem notes in the Foreword to the 1966 edition that he sought to 'preserve a problem, which I consider fundamental, in the same state of freshness as its everchanging factual data'. He believes that the role of philosophy is to investigate such problems, *ibid.*, p. 8: 'we are yielding to a demand of philosophical thought to reopen rather than close problems. Léon Brunschvicg said of philosophy that it is the science of solved problems. We are making this simple and profound definition our own; See also, *ibid.*, p. 36: 'the problem itself persists at the heart of the solution presumably given to it'.

¹⁵⁵ Heidegger (1997), p. 143.

¹⁵⁶ Lecourt (1975), p. 173.

Canguilhem's focus on concepts is inspired by Bachelard who observes that 'it is at the level of each concept that the precise tasks of the philosophy of the sciences are posed'.¹⁵⁷ Since Bachelard focuses on physics, chemistry, and mathematics, the question arises whether a focus on concepts is equally productive in the life sciences which seem much less 'rational'. Canguilhem, however, believes that concepts are especially suitable for inquiry into the life sciences because the process of living and the formation of concepts are somewhat alike. Both processes involve a continuous confrontation of problems¹⁵⁸ and are creative or productive.¹⁵⁹ The character of living processes themselves renders much inquiry by 'theory' useless.

2.1.5 Concepts as 'unification of a manifold'

Canguilhem adopts a particular style of writing for his discussion of concepts. He uses common sense terms, but subsequently changes the relation between them. This '*réversion*' is not a rhetorical trick.¹⁶⁰ Rather, it is a way to challenge and reorder the usually accepted relation between terms, thereby transforming the understanding of a concept. These shifts can be difficult to detect in Canguilhem's essays and therefore often go unnoticed.¹⁶¹

Something similar is at issue in Canguilhem's apparently innocent recovery, but implicit reconstitution of meaning, of Kant's original idea of the concept. Kant regarded a concept as a 'unification of a manifold'.¹⁶² He suggested that concepts can 'solve' the problem that the diversity of the empirical world represents for knowledge or understanding. Concepts gather empirical diversity within themselves and it is this unification that makes understanding possible. Canguilhem focuses on the 'flipside' of this idea by regarding a concept not as a solution to a problem of understanding, but as itself enveloping a manifold of problems. Since a concept - according to Kant - represents a unification of a manifold, this means that it necessarily contains diversity within itself. As Canguilhem observed:

¹⁵⁷ Ibid., p. 73.

¹⁵⁸ Osborne (2003), p. 10: Canguilhem does not focus like Bergson on the 'problem-solution composite' but rather on the 'open-ended provocation of the problematic; to scupper solutions in the name of the re-evaluation of values'.

¹⁵⁹ Ibid., p. 7: Bergson observed: 'stating the problem is not simply uncovering, it is inventing'.

¹⁶⁰ Piquemal (1985), p. 81: the 'inversion' of terms 'concentrates' the result of a philosophical analysis.

¹⁶¹ Ibid.: Perhaps this is because Canguilhem never introduces new terms but only uses current vocabulary. Hacking (1998), performs a dissection of one of Canguilhem's most notable inversion of terms (Canguilhem (1993), pp. 129-164, '*Machine et organisme*').

¹⁶² Heidegger (1997), p. 37; Zumbach (1984), p. 37 citing Kant: 'Just as the understanding unifies the manifold in the object by means of concepts, so reason unifies the manifold of concepts by means of ideas.'

[I]n other words, concepts are the synthetic and qualitative residues of a recently embarked upon dissection of experience: they do not have explanatory significance per se because they maintain diversity instead of eliminating it ... one understands that the ingenious effort of the scholastics to attribute a theoretical virtue to them remains in vain.¹⁶³

What was initially presented as a solution by Kant has now been identified as a problem by Canguilhem. However, for the latter the realization that a concept preserves a problem or envelops a diversity of values is not problematic; quite the reverse, it is precisely what makes a concept productive.

Canguilhem also adopts Kant's idea that a concept represents a 'point of view':¹⁶⁴

[I]n short, when we begin to dissect the perceptual chaos by searching for the 'genres' of things, we are lead - in order to understand things - to multiply not only these genres but the 'points of view' from which they *appear* to us and this is how we constitute *concepts*.¹⁶⁵

Rather than referring these points of view back to a centre of cognition or understanding, such as a subject, Canguilhem emphasizes the necessary multiplicity of these points of view in accordance with the diversity of experience.

2.1.6 *A manifold of concepts*

Since a concept functions by reference to itself and other concepts, it is never an isolated instrument of knowledge. For example, even if the social and life sciences sometimes refer to a singular and often undefined concept of 'life',¹⁶⁶ this concept actually relies on a variety of concepts and their interrelation. The concepts to be discussed do not represent any particular function of 'life', in the way that Aristotle described life through its differentiated functions.¹⁶⁷ Rather, these concepts - together with a manifold of other concepts - can be regarded as forming a patchwork or an 'intellectual multiplicity'.

¹⁶³ Canguilhem & Planet (1939), p. 95 (my translation).

¹⁶⁴ Canguilhem (2002), p. 343.

¹⁶⁵ Canguilhem & Planet (1939), p. 94 (my translation).

¹⁶⁶ Agamben (2002), p. 26: it is precisely the indeterminate character of this concept of 'life' that enables its continuous articulation and fragmentation.

¹⁶⁷ Ibid., pp. 27-28.

As Canguilhem observes: 'science and philosophy presuppose the existence of a network or configuration of forms through which cultural productions are perceived'.¹⁶⁸ Similarly to Foucault's idea of 'episteme', such concepts enable us to consider the possibility of a particular science at a particular point in time.¹⁶⁹ Canguilhem notes that

[T]o work a concept means to vary its applicability and meaning, to generalise it by incorporating its exceptions, to export it outside of its original context, to take it as a model or - conversely - to seek a model for it, in short: to progressively attribute through certain transformations the function of a 'forme' to that concept.¹⁷⁰

I argue that the concepts to be discussed in the following chapters have come to represent 'forms' through which the life and social sciences rehearse and repeat the particular relation between knowledge and living processes that lies at the basis of modern rationality since Kant. Whereas Kant described concepts as necessary constraints that enable the intelligibility of the processes they refer to, these concepts are discussed - following Canguilhem - in order to release (rather than unify) the diversity of problems and values that they integrate in their form.

2.1.7 *A continuous concept: the 'vivant'*

A concept that is not addressed in a separate chapter, because it traverses Canguilhem's entire work, is the '*vivant*'. The *vivant* cannot be regarded as a 'concept among concepts'.¹⁷¹ It could perhaps be called 'life' if that term was not so laden with its own particular history and was not itself associated with the type of rationality that Canguilhem seeks to question. The word *vivant* is a commonly used French word that, at first sight, does not attract much attention. However, Canguilhem's recurrent use of this word makes his ideas on the living resonate throughout his writing. Literally, the *vivant* means that which is alive.

¹⁶⁸ Canguilhem (1994b), p. 76.

¹⁶⁹ Ibid., p. 77: 'This basis of a possible science is what Foucault calls an *episteme*. As such it is no longer the primary code of Western culture, and it is not yet a science like Huygens's optics nor a philosophy like Malebranche's system. It is what is required for us to even imagine the possibility of that optics in Huygens's day or that philosophy in Malebranche's, rather than three-quarters of a century earlier.'

¹⁷⁰ Duroux (1993), p. 50, citing Canguilhem; Macey (1998), p. 172: this citation was used as a motto in every issue of the *Cahiers pour l'analyse* published by the ENS's *Cercle d'épistémologie*.

¹⁷¹ Canguilhem (2002), p. 344: 'The conception of concepts cannot be a concept among concepts.' (My translation).

Although the *vivant* is strictly speaking a noun, it has a different connotation. It is a verb turned into a noun which nevertheless continues to operate as a verb within the restrictions imposed upon it by language. The *vivant* cannot be regarded as an organism or as an identifiable living form, nor - and much less - as a living *being*. Rather, it denotes the ongoing process of life or living that defies traditional understandings of knowledge.

Canguilhem's reference to the *vivant* is also a constant reminder of how he seeks to distinguish life from lived experience. He observes: 'By life (*'vie'*), we can understand either the present participle or the past participle of the verb 'to live', the *vivant* or the *'vécu'*. The second is, in my opinion, controlled by the first which is more fundamental.'¹⁷² Canguilhem believed that insufficient philosophical interest had been shown for the *vivant*.

He notes how, since Descartes, the philosophy of biology became 'a somewhat suspect genre of speculation'.¹⁷³ Philosophizing about 'life' was not only regarded as a rather dubious exercise but, more importantly for philosophers, living was regarded as '*l'expérience du fait de vivre*'.¹⁷⁴ The philosophical focus was, therefore, on life as existence or lived experience in the sense that existentialists such as Sartre gave to this term. For these philosophers, life in the sense of the *vivant* rather than the *vécu* was simply not an issue. Canguilhem introduced the idea of the *vivant* in order to remedy this oversight.

The introduction of the notion of the *vivant* can be regarded as a break with the French tradition in the life sciences that, as Rabinow observes, 'has never posited a *zoe* it could not civilize'.¹⁷⁵ The *vivant* is not a 'civilized' notion of life because it does not represent lived experience or any other qualified form of life. At the same time, it cannot be regarded as the 'bare life' that Agamben describes¹⁷⁶ because, according to Canguilhem, all living processes are normative (see Chapter 6). It could be argued that the *vivant* is a transcendental form because of its distinction from experience.¹⁷⁷ However, Canguilhem understands it as the practical process or techniques of living rather than as a transcendent form of 'Life'.

¹⁷² Ibid., p. 335 (my translation).

¹⁷³ Canguilhem (1947), p. 324 (my translation).

¹⁷⁴ Ibid.

¹⁷⁵ Rabinow (1999), p. 109.

¹⁷⁶ Agamben (1998).

¹⁷⁷ Cf. Foucault (2006), p. 264.

2.2 What happens when life becomes subject?

2.2.1 The 'vivant' as subject

Although Canguilhem's distinguishes between the *vivant* and the *vécu* and proposes a philosophy that centres around concepts rather than a subject, it has been suggested that the *vivant* represents a subject. Something like a subject, at least, seems to emerge from Canguilhem's frequent references to notions such as 'value' ('*valeur*'), 'need' ('*besoin*'), and 'meaning' ('*sens*') and from his suggestion that a living process represents a centre of reference that is absolute.¹⁷⁸ However, I argue that the traditional idea of the subject as it emerges - for example - from Kant's philosophy cannot be compared to Canguilhem's idea of the *vivant*. The *vivant* represents the process of living and is not used as the point of departure of a normative or epistemological theory (see Chapter 4).

Even if life cannot be identified with a subject in Canguilhem's work, it can safely be said that it forms the subject matter of his work. However, the life sciences do not merely represent a field of inquiry. I argue that they provide the necessary environment in which Canguilhem's arguments can unfold. In fact, his ideas could not be elaborated with reference to anything *other* than the life sciences because their particular subject matter seems uniquely capable of challenging reason. As Canguilhem observes: reason is 'put to shame' by life.¹⁷⁹ Whereas reason calculates, adds, and subtracts, 'life means production or, as has also been said, emergence'.¹⁸⁰ Canguilhem's work, I argue, is particularly effective in engaging with Kantian rationality because Kant and Canguilhem share a common interest: the life sciences. Kant elaborated his system of reason by reference to living processes (see Chapter 2). The life sciences should, therefore, be able to provide a means - perhaps the only means - of questioning Kant's system.

¹⁷⁸ Lecourt (1998); Badiou (1998) refers to the idea that a 'virtuality of the subject' can be found in the 'knot of centre, norm and meaning'.

¹⁷⁹ Canguilhem (1947), p. 326 (my translation); Canguilhem refers to '*La gêne de la raison devant l'objet vie*'.

¹⁸⁰ Ibid., p. 327 (my translation).

2.2.2 The significance of the 'reflex'

What are the consequences of choosing the life sciences as the environment for arguments to unfold? The life sciences are productive and, at the same time, challenging because their subject matter continuously 'questions its own propositions'.¹⁸¹ When the *vivant* is taken as subject matter, a continuous questioning or evaluation of assumptions is the necessary result. The most obvious reason for this is that living processes evolve, adapt, and transform continuously. As Dagognet observes, it is partly the focus on this particular field of inquiry that gives rise to one of the particularities of Canguilhem's thought: the way in which it constantly seems to question itself.¹⁸² Every theory raises its own obstacles, however, Canguilhem's thought reflects on its own assumptions in a very particular way.

For example, as Dagognet points out, one of the main questions that concerns Canguilhem is whether 'knowledge of life' is possible. If the answer to this question is affirmative then it defeats his own argument that living processes defy modern theories of understanding. If the answer is negative then it puts his own work in danger of irrelevance.¹⁸³ Another example of such a self-imposed challenge is Canguilhem's elaboration of the concept of 'reflex' in his thesis in philosophy.¹⁸⁴ The concept of the reflex does not only represent the subject matter of his thesis but, at the same time, puts his thesis into question. As Dagognet observed: 'In fact, even if he doesn't address it explicitly, it is certain that his inquiry into the concept of 'reflex' impacts on his philosophy. It becomes his Achilles heel because the concept of 'reflex' necessarily puts everything in question.'¹⁸⁵ In other words, while he addresses the phenomena of the reflex in living processes, Canguilhem introduces reflexivity - as epistemic idea - into his work.¹⁸⁶ This implies a continuous change of perspective that necessarily gives rise to a reassessment of his own assumptions.

¹⁸¹ Dagognet (1997), p. 125 (my translation).

¹⁸² Ibid., p. 115: 'In this way, the thought of Georges Canguilhem does not cease to battle itself: it is in perpetual tension and reflection.' (My translation).

¹⁸³ Ibid., p. 119.

¹⁸⁴ Canguilhem (1977).

¹⁸⁵ Dagognet (1997), p. 91 (my translation).

¹⁸⁶ See Hayles (1999), pp. 8-9 on reflexivity.

PART III

3.1 The negotiation of life in social science

3.1.1 *Biocapital and facts of life that travel*

Writings in the social sciences that focus on the life sciences take many different forms. The intention is not to provide an overview of all the work that is in some way or other related to this particular field of inquiry. Rather, the intention is to briefly represent some of the writing in the social sciences that engages either with Canguilhem's work or with the concepts that structure his thought. More specific reference to such writings will be made, where necessary, in each of the chapters. A common characteristic of many writings is that they are framed in terms of technological change.¹⁸⁷

The focus of inquiry is on the impact of technology on living processes; more specifically on how such processes behave, are represented, and are understood. Another, but related, focus of inquiry is how technological developments render living processes more susceptible - or susceptible in different ways - to human manipulation and intervention. Technology is, in this regard, usually represented as impacting upon living processes and - at the same time - as being implicated in such processes. The functioning of organisms themselves is often regarded as the primary form in which technology manifests itself.

One strand of writing focuses on the ways in which biological processes and entities have come to be defined and produced through the ways in which they travel. Such 'travelling' is regarded either as geographical displacement or represents the mediation of living processes through information technology.¹⁸⁸ The unified notion of 'life' that some writing refers to is replaced by multiple diffracted objects and processes and their technological environments. An important focus of this type of writing is the distinction between information and matter; the traveling of living entities is thought to become possible only once such entities have shed their material form. These writings are particularly influenced by the information metaphor that dominated the life sciences at the end of the twentieth century (see Chapter 5).

¹⁸⁷ See, for example, Parry (2004); Helmreich (1998); Thacker (2005).

¹⁸⁸ Parry (2004a); Thacker (2004).

Another strand of writing focuses on the way in which modern technology facilitates the capitalization of living processes and how such processes come to be regarded as products.¹⁸⁹ It also addresses the replacement of traditional notions of production in relation to living processes with the reproduction that such processes themselves represent.¹⁹⁰ It is often argued that the possibility of control and manipulation of reproductive processes in the contemporary life sciences gives rise to the greater potential for capitalization of living entities.

This type of writing also focuses on the mutual information and transformation of forms of capitalism and the contemporary life sciences. This process of mutual informing has been called 'biocapital',¹⁹¹ and is differentiated from other - seemingly similar - notions such as 'biovalue'.¹⁹² The latter is used to designate a kind of 'added' or surplus value that living processes are thought to represent. Biocapital, on the other hand, is used to address how terms traditionally associated with capitalism such as value, production, and distribution are changing partly through developments taking place in the life sciences.

3.1.2 *'New epistemologies of life' - a change in scale*

Other writing in the social sciences that focuses on the contemporary life sciences engages more directly with Canguilhem's thought, albeit through the lens of Foucault. These writings refer to so-called 'new epistemologies of life' that are said to have emerged in the twentieth century.¹⁹³ These 'new epistemologies' are mainly attributed to a change in scale. It is the 'flattening' of the life sciences - from the depths of the body to the immediately, if mediated, visibility of molecules-¹⁹⁴ that gives rise to new forms of knowledge regarding the living.

This change in scale seemingly opens up the possibility of understanding processes that were previously deemed unknowable.¹⁹⁵ What is at issue here is not so much whether or

¹⁸⁹ Sunder Rajan (2006); Parry & Gere (2006).

¹⁹⁰ Franklin & Lock (2003), pp. 8-11.

¹⁹¹ Sunder Rajan (2006); Franklin & Lock (2003), pp. 6-8.

¹⁹² Waldby (2002).

¹⁹³ N. Rose (2007), p. 259.

¹⁹⁴ N. Rose (2001), p. 13.

¹⁹⁵ N. Rose (2007), p. 4: At the molecular level, 'it seems, there is nothing mystical or incomprehensible about our vitality - anything and everything appears, in principle, to be intelligible, and hence to be open to

not the functioning of living processes is actually understood. Rather, it concerns the opening up of the *possibility* of knowledge regarding living processes. The ‘appearance’ of intelligibility and the change in the possibility of knowledge regarding living processes are themes that can be traced back to Kant. The idea of a change in scale that holds out the promise of an increased intelligibility of living processes goes hand in hand with an increased possibility of intervention in such processes.

This type of writing seeks to move ‘beyond’ traditional epistemology and inquire into new ways in which living processes are known.¹⁹⁶ However, in order to move beyond it, it is necessary to understand the foundations of such epistemology. It is not enough to recognize that it is historically and socially situated. I argue that the ‘new epistemologies of life’ are, in fact, not that new because they involve a change of scale rather than a change in how the relation between knowledge and living processes is envisaged. This type of writing, even if it engages most directly with Canguilhem’s work, does not take into account what is arguably the most productive part of that work: the way in which it questions modern rationality through some of its most basic concepts.

3.2 What to do with heritage?

3.2.1 *The consequences of heritage*

Writings in the social sciences that focus on the contemporary life sciences tend to rely in one way or other on a traditional notion of ‘life’ as that which makes knowledge possible and at the same time eludes it. Although general reference is made to the ‘epistemological mutation that occurred in the nineteenth century’ that allegedly gave rise to this notion of life, the circumstances of this ‘epistemological mutation’ are rarely addressed.¹⁹⁷ Instead, the main focus is on the fragmentation, mobilization, and capitalization of living processes which are themselves often described in terms of their ‘contingency’.¹⁹⁸

Contingency is usually represented as a particular characteristic of the twentieth and twenty-first century. However, Luhmann observes that a preoccupation with - or insistence

calculated interventions in the service of our desires about the kinds of people we want ourselves and our children to be.’

¹⁹⁶ Rabinow (1996), p. 28.

¹⁹⁷ N. Rose (2007), p. 42.

¹⁹⁸ Parry (2004a); Thacker (2005).

on - contingency is characteristic of modernity more generally.¹⁹⁹ Foucault similarly refers to Baudelaire who defined modernity as ‘the ephemeral, the fleeting, the contingent’.²⁰⁰ In fact, Kant used the notion of contingency to distinguish living processes and exclude them from his theory of understanding.

Neither the traditional representation of life as that which grounds knowledge and escapes it, nor the references to ‘contingency’ can be understood without taking into account the intellectual heritage of these ideas. As Canguilhem observes: ‘in a theoretical fabric, certain threads can be entirely new, while others are taken from earlier weavings. The Copernican and Galilean revolutions also involved the preservation of a heritage.’²⁰¹ According to Luhmann, the problem is not so much the maintenance of heritage as the ‘constant creation of otherness.’²⁰² In other words, although heritage is necessarily preserved and repeated in contemporary theorizing, there is a constant necessity to differentiate contemporary ideas from such heritage.

I argue that it is necessary to recognize the heritage of particular ideas that inform the contemporary life and social sciences. Until this heritage is explored and understood it is, for example, impossible to appreciate how the relation between knowledge and life seems to be shifting from a unification of diversity to an appreciation of contingency. Whereas Kant suggested that it was necessary to unify the diversity or contingency of living processes in order to make them intelligible, the contemporary life sciences seem to epistemologically embrace contingency and diversity (see Chapter 6, para. 4.1.2).²⁰³

¹⁹⁹ Luhmann (1998), p. 44: ‘the reference to contingency is so instinctive that it is a part of any search for necessity, for validity a priori, for inviolate values.’

²⁰⁰ Foucault (1984), p. 39. Foucault believed that ‘being modern does not lie in recognizing and accepting this perpetual movement; on the contrary, it lies in adopting a certain attitude with respect to this movement’.

²⁰¹ Gutting (1989) citing Canguilhem, p. 40.

²⁰² Luhmann (1998), p. 3.

²⁰³ Rheinberger (1997a), p. 227: ‘If ontical complexity has to be reduced in order to make experimental research possible, this very complexity is *epistemically* retained.’; see also Oyama (2000), p. 116, for the difference between ontological contingency (‘causal dependency’) and epistemological contingency (‘unpredictability’).

PART IV

4.1 An overview of chapters

4.1.1 *Life sciences and modern rationality*

This chapter addresses the main theme that runs through, and resurfaces in, all of the chapters, namely the relation between modern rationality and the life sciences. Each of the following chapters then addresses a particular concept that expresses that rationality and how Canguilhem explored it. This chapter addresses the way in which the life sciences have come to lie at the heart of modern rationality by reference to the work of Kant. He formulated the idea that living processes represent at once the condition of possibility and the limit of knowledge.

For Kant, it is this particular relation to knowledge that unifies the manifold living processes; it is that which they have ‘in common’ and what, from Kant’s explanation onwards, defines them as ‘living’. Foucault observes how, at a certain point in time, ‘Life’ became a ‘fundamental form of knowledge’.²⁰⁴ This statement could mean that ‘life’ becomes the concept around which research is organized and experiments are conducted. However, I argue that Foucault refers to the way in which Kant positioned living processes at the heart of knowledge and understanding.

I argue that the autonomy of reason that Kant’s system seeks to establish, and that comes to define modern rationality, is made possible through a two-pronged approach. It is established through a simultaneous reliance on, and exclusion of, living processes from the process of knowledge or understanding. The reliance on living processes is represented by Kant’s well-known epigenesis metaphor in the second edition of his first *Critique*, while the exclusion of living processes from knowledge is elaborated in his third *Critique*. The latter is effected through the regulative principle of purposiveness, also described by Kant as the ‘lawfulness of the contingent’.²⁰⁵ I argue that it this two-pronged approach that comes to represent the traditional figure of ‘life’, as discussed by philosophers from the nineteenth century onwards, as that which makes knowledge possible and at the same time

²⁰⁴ Foucault (2006), p. 275.

²⁰⁵ Ginsborg (1997), p. 339: refers to the different expressions that Kant used to designate this principle.

escapes it. I argue that Canguilhem's work can be read as a critical engagement with Kant's particular idea of reason and the separation between knowledge and life on which it relies.

4.1.2 The problem of 'environment'

The idea of the environment and its relation to the individual organism is being rethought in the contemporary life sciences. The gene centrism that characterized the latter half of the twentieth century has given rise to a renewed focus on environment and development. However, the environment has always represented a somewhat problematic concept for philosophy and the sciences. I explore Canguilhem's observation that a biological concept of environment does not exist. The original concept of environment is derived from physics. However, rather than abandon such a notion of environment in the life sciences - as has been suggested - I argue that Canguilhem's work suggests a return to Newton's concept of 'milieu' in physics. What can be recovered from that concept is the idea that 'milieu' is inherently ambiguous and represents a medium that facilitates - what Luhmann calls - 'action out of action'.²⁰⁶

Canguilhem begins his inquiry into the notion of 'milieu' by suggesting that it has become a 'category of contemporary thought'.²⁰⁷ He asks what role this notion can fulfill within a 'philosophy of nature centred on the problem of individuality'.²⁰⁸ Since the focus in both the life and social sciences has traditionally been on the individual, whether in the form of the cell or the subject, the environment is not attributed the same significance. It is usually represented as a condition of possibility for the emergence of the individual, as resource, or as a geographical space. I argue that the concept of environment is much richer than traditional inquiries would suggest and explore this, following Canguilhem, through Newton's idea of aether as milieu, the 'internal milieu' of Claude Bernard, and the associated milieu of von Uexküll.

I argue that traditional representations of environment obscure the potential of the concept that lies in its introduction of a certain measure of contingency that destabilizes traditional centres of reference. The potential of environment is explored by reference to Luhmann's use of the notion in his systems theory. To some extent, Luhmann's ideas were inspired by

²⁰⁶ Luhmann (1996), pp. 110 and 118: this is a "subject free" concept of action'.

²⁰⁷ Canguilhem (2003), p. 165.

²⁰⁸ Ibid.

Canguilhem's discussion of 'milieu'. I argue that the particular role that Canguilhem and Luhmann attribute to the notion of environment signifies a shift in rationality; from a Kantian focus on the subject to a focus on relations, forces, and action upon action. In this way, the concept of environment challenges the notion of the privileged centre of reference that characterizes modern rationality.

4.1.3 *The problem of 'individuality'*

Whereas the environment has been largely neglected as a theoretical notion, the concept of the individual represents the traditional object of inquiry of both the life and social sciences. However, the individual - whether in the form of the 'gene' or the 'subject' - has come to be regarded as a concept that is too unrefined to address the developments in the contemporary life and social sciences. It is questionable whether the relations, networks, and pathways that define contemporary biology can still be understood by reference to individuality.

Although it has been argued that the introduction of the concept of information into the life sciences has fragmented the traditional individual, there seems to be a continuous preoccupation with individuality as evidenced through the proliferation of notions such as emergence, ontogeny, and autopoiesis. These notions seem to indicate a shift from the progressive development or identification of an individual entity to a variety of processes of individuation. This raises a number of questions: how has the notion of the individual transformed? And: what is the meaning of individuality in the contemporary life and social sciences?

These questions are explored through Canguilhem's inquiry into the 'problem of individuality' that he discussed by reference to the history of the concept of the cell. I argue that the cell, in Canguilhem's essay, represents at the same time the manifestation of biological individuality and the means to question the problem of individuality. Canguilhem describes how, even if a particular representation of individuality is contested, the problem of individuality itself persists. He explores the particular imagery of the individual form and the values and emotions that are associated with it in order to explain the recurrence of individuality as a question.

His discussion is contrasted with the identity, unity, and autonomy that characterize the individual in Kant, as well as with the idea of ‘self-overcoming’ described by Nietzsche. I argue that Canguilhem’s discussion of individuality, following Nietzsche, portrays the individual as a process, a mechanism, or a series of techniques rather than an actual form or identifiable entity. Canguilhem’s discussion resonates in the subsequent ideas about individuality of Simondon, who describes the individual as a temporal process; Foucault, who describes the ‘*rapport à soi*’²⁰⁹ as a fundamental historical form; and Luhmann who describes the unity of the system as a process of self-description and differentiation. The individual emerges as one of the main concepts of modern rationality; as a normative concept that expresses a certain ideological commitment.

4.1.4 The problem of ‘information’

The notion of information dominated the life sciences during the second half of the twentieth century. However, the influence of this notion seems to be waning because its use has given rise to some unsatisfactory consequences. For example, the notion of information reinforced the distinction between genetic material and environment and its role as a metaphor was contested. Most inquiries associate information with control and, because information is often equated with a certain interpretation of Aristotelian form, it is regarded as enabling control of the very essence of living processes. Although the notion of information has been somewhat ‘overtheorized’, I argue that some important aspects have largely been left unexplored.

Most notably, the slippage between the ancient idea of form and the modern notion of information tends to go unquestioned. I argue that the identification of form and information relies on an oversimplified representation of Aristotle’s idea of form. Aristotle’s idea of form was not characterized by its distinction from matter. Rather, he elaborated the notion precisely to challenge this distinction. I argue that Aristotle’s notion of form has many forms but is primarily characterized by its meaning as an active principle and a process of actualizing potentiality.

It has been argued that Canguilhem did not explore the concept of information in the life sciences in any detail. I argue that his discussion of information is productive because it

²⁰⁹ Foucault (1984b), p. 12.

moves away from the debate about form and matter to an inquiry into the significance of the notion for the relation between knowledge and life. I argue that Canguilhem believes that the notion of information has the potential to transform the relation between knowledge and living processes established by Kant. Whereas Kant regarded knowing and living as separate processes that are subject to different principles and regimes, the understanding of living processes through the concept of information undermines this distinction. The notion of information also facilitates Canguilhem's project of providing a central role to 'error' in relation to knowledge

4.1.5 *The problem of 'normativity'*

Canguilhem's idea of 'vital normativity' is often regarded as obsolete. It has, for example, been regarded as describing the organic ontology of living processes and has been associated with vitalism - a mode of thought that has become largely irrelevant in the contemporary life sciences. Moreover, the distinction between the normal and pathological by reference to which Canguilhem elaborated his idea has arguably been complicated by notions such as risk, mutation, and enhancement. To the extent that Canguilhem's peculiar notion of normativity retains some significance, this is largely attributed to the inspiration it provided for Foucault's subsequent idea of 'biopower'.

I argue that the original intention and significance of Canguilhem's notion of normativity have been overshadowed by traditional interpretations of the normative as moral or ethical and later associations of the normative with normalization and control. I argue that his idea is significant for the social sciences because, although he discussed 'vital normativity' with regard to living processes, Canguilhem in fact devises a new theoretical instrument. His idea of normativity provides an alternative to traditional connotations of the normative with the norm/fact distinction and makes an appreciation of contingency possible.

I argue that Canguilhem elaborated his notion of normativity in response to Goldstein's call for a biological concept of the norm. The latter believed that traditional interpretations of the normative could not accommodate living processes. There was no idea of normativity available in the life sciences other than the understanding of the norm as ideal or average. According to Goldstein, what was required was a concept of the norm that was generally valid, could - nevertheless - account for the individual, but was not subjective. Canguilhem

elaborated his idea of normativity with reference to the distinction between the normal and pathological in medicine and by making use of the inherent ambiguity of the norm.

This chapter describes the genealogy of Canguilhem's idea through Kant's and Nietzsche's respective ideas of the normative in relation to living processes. I argue that two types of normativity can be distinguished in Kant's work. First, the norm as principle of understanding or rule of judgment employed by a subject. Second, a normativity at the level of the living process. However, Kant probably did not wish to recognize this second type of normativity because it would result in the impossibility of unifying the diverse. Subsequently, I explore Nietzsche's idea of life as a manifestation of 'will to power' and its influence on Canguilhem's notion of vital normativity.

I argue that Canguilhem's normativity is not a concept like other concepts. Rather, it envelops and expresses his critique of *Critique* and the project of 'rationalization' that it gives rise to. His notion of normativity is not moral or ethical. Rather, it signifies the diverse techniques of living; the processes of confronting the predicaments of life. I explore how this notion of normativity influenced Foucault's ideas of 'biopower' and 'normalization' and how it corresponds with other theories, such as that of Luhmann, that rely on a certain measure of contingency. I argue that Canguilhem's normativity represents an alternative to the traditional understanding of the normative that informs modern rationality.

2. LIFE SCIENCES AND MODERN RATIONALITY

PART I

1.1 Introduction

1.1.1 *The 'threshold of modernity'*

Much recent engagement of the social sciences with the life sciences has been motivated by Foucault's observation that

[F]or millennia, man remained what he was for Aristotle: a living animal with the additional capacity for a political existence; modern man is an animal whose politics places his existence as a living being in question.¹

Foucault attributes a central role to 'life', irrespective of the many ways in which that notion may be defined. What is in question is Foucault's notion of 'biopower', the question of how modernity can be defined by the way in which life occupies the heart of regimes of knowledge and power. We will inquire in Chapter 6 into Canguilhem's notion of 'vital normativity' and how it influenced Foucault's notion of 'biopower'. For now, however, it suffices to say that Foucault was concerned to identify a turn or a transition to a different kind of knowledge and power that emerged at a particular moment in time, when 'life and its mechanisms'² entered into the realm of knowledge and politics.³ For Foucault, this event marks the 'threshold of modernity'.⁴

The statement and its suggestion that the transition which is identified represents the 'foundational event'⁵ of modernity have been echoed by many writers.⁶ In a sense this is surprising because the meaning of the statement is not entirely clear. In particular, it does

¹ Foucault (1998), p. 143.

² Ibid.

³ Ibid., pp. 141-142: 'the entry of life into history, that is, the entry of phenomena peculiar to the life of the human species into the order of knowledge and power, into the sphere of political techniques'.

⁴ Ibid., p. 143.

⁵ Agamben (1998), p. 4.

⁶ Rose (2001), p. 1; Rabinow (1998), p. 194. Agamben (1998), pp. 8-9: Agamben, however, believes that this 'Foucauldian thesis will then have to be corrected or, at least, completed', because the "politicization" of bare life' has always defined (sovereign) power.

not clarify how living processes - which were apparently initially regarded as just that - came to be associated with politics or knowledge. How exactly did this transition come about and why did it come about at this particular moment in time? Foucault does not answer these questions when introducing his idea of 'biopower'. He refers only briefly to a shift in regimes of knowledge, which he described in his earlier work, from what he called the classical episteme of representation to modern rationality.⁷ However, in that earlier work the shift from one episteme to another was described rather imprecisely;⁸ Foucault only loosely refers to the Kantian *Critique* as the basis of modern rationality.⁹

In a different essay, Foucault observes with regard to Kant's essay on the meaning of the Enlightenment:

[I]t seems to me that it marks the discreet entrance into the history of thought of a question that modern philosophy has not been capable of answering, but that it has never managed to get rid of, either. And one that has been repeated in various forms for two centuries now.¹⁰

I argue that in order to understand what motivates Canguilhem's work, and what brings about the transformation or transition Foucault is referring to, it is necessary to go back to this defining moment in the eighteenth century: Kant's elaboration of his theory of understanding. Foucault argued that the transformation of the role of life should be sought in

the new mode of relation between history and life: in this dual position of life that placed it at the same time outside history, in its biological environment, and inside human historicity, penetrated by the latter's techniques of knowledge and power.¹¹

I argue that the 'dual position of life' that Foucault describes can be traced back to the particular way in which Kant formulated the relation between life and knowledge in his first and third *Critique*.

Foucault believed that the significance of Canguilhem's work extended beyond its strictly delineated field of inquiry because of the way in which it engaged with modern

⁷ Foucault (1998), p. 143.

⁸ Foucault (2004), Chapter 7. See for criticism on Foucault's grasp of history: Flynn (1994), p. 44; Gutting (1994), pp. 48-49 and 65; Megill (1987), pp. 128-129.

⁹ Foucault (2004), pp. 155. See *ibid*, pp. 154-156, for references to the role of the Kantian Critique; Norris (1994), p. 184, argues that Foucault treats Kant's project as 'just another episode in the history of bygone discursive formations'.

¹⁰ Foucault (1984), p. 32.

¹¹ Foucault (1998), p. 143.

rationality.¹² He hints at the idea that Canguilhem's work proposes a transformation of knowledge because it focuses on the relation between knowledge and life rather than on the traditional triangle of knowledge, truth, and subject - a transformation that Kant himself, perhaps inadvertently, suggested.¹³ However, Foucault did not elaborate on his ideas. In what follows, I explore Foucault's suggestions.

I argue that Kant established the relation between knowledge and life through a two-pronged approach. On the one hand, he establishes his idea of pure reason by reference to living processes. More specifically, through an analogy between the process of understanding and the biological process of epigenesis. On the other hand, Kant excludes living processes from his theory of understanding through the idea of a 'lawlikeness of the contingent'.¹⁴ I go on to identify what Kant was getting at through this particular description of the relation between life and knowledge. I also address briefly why this relation, which was established by Kant more than two centuries ago, still seems to be negotiated in the contemporary life and social sciences. Finally, I argue that while Foucault elaborates his work against this background it was not Foucault who engaged with the Kantian *Critique*. Rather, it was Canguilhem who explored the particular rationality that Kant's system gave rise to through the concepts that he addressed. I argue that, even if Canguilhem does not often challenge Kant explicitly,¹⁵ he reveals the problematic nature of the rationality that Kant proposes and of the 'dual position' that characterizes living processes in Kant's work.

1.2 A curious analogy

1.2.1 The origin and the analogy

The origin of modern rationality is undoubtedly impossible to establish. Not only is it debatable what modern rationality exactly consists of - as has been said: 'Modernity itself

¹² Foucault (1978), p. xii: 'Works such as those of Koyré, Bachelard, or Canguilhem could indeed have had as their centers of reference precise, 'regional', chronologically well-defined domains in the history of science but they have functioned as important centers of philosophical elaboration to the extent that, under different facets, they set into play this question of the Enlightenment which is essential to contemporary philosophy.'

¹³ Ibid., p. xx: Foucault refers to Kant's *Critique of Judgment* and to Hegel's *The Phenomenology of Spirit*.

¹⁴ See, e.g., Kant (1987), p. 405, section VI, para. 217': 'purposiveness is a lawfulness that [something] contingent [may] have [insofar] as [it] is contingent'.

¹⁵ Canguilhem (2002), pp. 351-352: the most explicitly formulated criticism of Kant's *Critique*.

... cannot be taken as a blanket state of affairs, a social *a priori* that is not itself embedded in the shifting sands of history'¹⁶ - but it would be difficult to reduce all the various aspects associated with it to one particular cause or origin.¹⁷ The 'origin' is a contested notion in itself because it, perhaps paradoxically, seems to lack a beginning. An origin always 'refers back' without giving rise to an origin in retrospect.¹⁸ Moreover, searching for an origin at a particular point in time leads to the disregard of various historical particularities and eventualities.¹⁹ Although the circularity or paradox of the origin is unavoidable, it nevertheless invites an effort to somehow 'break into' this circularity in order to inquire into the beginnings of modern thought.²⁰

At one particular beginning of Western rationality, then, lies not a definition - not even a category or a concept - as one would perhaps expect. Rather, what lies there is a curious, and some would even say dubious, analogy. Although it is impossible and perhaps undesirable to anchor the emergence of modern rationality in one particular time or place, few would dispute that it was elaborated in its most programmatic form by Immanuel Kant in his *Critique of Pure Reason* (*Kritik der Reinen Vernunft*) in 1781.²¹ The analogy that lies at the core of this work, i.e., there where the most important part of his theory is elaborated, compares - simply put - the emergence of reason with a biological process. Kant, who is known more as a moral philosopher than as a philosopher of science,²² compares the emergence of the categories of understanding to the biological process of epigenesis.

The text of this analogy reads as follows:

Now there are only two ways in which a necessary harmony of experience with the conceptions of its objects can be cogitated. Either experience makes these conceptions possible, or the conceptions make experience possible. The former of these statements will not hold good with respect to the categories (nor in regard to pure sensuous intuition), for they are *a priori* conceptions, and therefore independent of experience. The assertion of an empirical origin would attribute to them a sort of *generatio aequivoca*. Consequently, nothing remains but to adopt the second alternative (which

¹⁶ Jasanoff (2004), p. 28.

¹⁷ Cf. Agamben (2008), p. 35.

¹⁸ Casey (1984), p. 601: Jacques Derrida said, with reference to the origin of Western thought: 'everything begins by referring back, that is to say, does not begin'. See Winthrop-Young (2003), p. 312 on Luhmann's rejection of the origin.

¹⁹ Agamben (2008), pp. 95-96: Foucault elaborates his 'genealogy' on the basis of Nietzsche's dismissal of '*Ursprung*'.

²⁰ Ibid., p. 30: As Heidegger says, 'the important thing is not to break the circle, but to access it in the right way' (my translation).

²¹ Kant (2003).

²² This distinction is only a recent one and is more prevalent in Anglo-American philosophy than in 'continental' philosophy. Many philosophers, from Aristotle to Kant and Hegel, wrote about morality as well as the sciences.

presents us with a system, as it were, of the *Epigenesis* of pure reason), namely, that on the part of the understanding the categories do contain the grounds of the possibility of all experience ...

It is quite possible that someone may propose a species of *praeformation-system* of pure reason - a middle way between the two - to-wit, that the categories are neither innate and first *a priori* principles of cognition, nor derived from experience, but are merely subjective aptitudes for thought implanted in us contemporaneously with our existence, which were so ordered and disposed by our Creator, that their exercise perfectly harmonizes with the laws of nature which regulate experience. Now, not to mention that with such an hypothesis it is impossible to say at what point we must stop in the employment of predetermined aptitudes, the fact that the categories would in this case entirely lose that character of *necessity* which is essentially involved in the very conception of them, is a conclusive objection to it.²³

This analogy has generally been overlooked by commentators on Kant's work. Recently, however, interest in the analogy has increased.²⁴ This change can perhaps be explained by the recent expansion of interest in Kant's writings on the life sciences in general.²⁵ The different scenarios for the emergence of pure reason that Kant discusses in his first *Critique*, each of which he compares with a biological process, raises many questions: what does this analogy mean? Why does Kant resort to epigenesis? What effect does the use of this analogy have? Before we address these questions, some further background is required concerning the project that Kant elaborates in the *Critique of Pure Reason*.

1.2.2 The justifications for critique

The project that Kant elaborates in the *Critique of Pure Reason* was strongly influenced by the political situation and the intellectual climate of the time. For purposes of clarity, Kant promoted the relevance and urgency of his project by situating it - and providing justification for it - at three different levels: the political, the philosophical, and the scientific. Each of these levels neatly intertwine to provide his philosophy with its critical edge. The meaning of 'critical' is explained by Kant when he says 'I do not mean by this a criticism of books and systems, but a critical inquiry into the faculty of reason'.²⁶ Such a 'critical inquiry' means an inquiry into the faculty of reason 'with reference to the

²³ Kant (2003), pp. 95-96, 'Of the Deduction of the Pure Conceptions of the Understanding', Section II.

²⁴ Wübnig (1969); Genova (1974); Zöllner (1988); Ingensiep (1994); Müller-Sievers (1997), p. 3; Sloan (2002); Zammito (2003).

²⁵ Most recent publications focus on Kant's *Critique of Judgment*: Lenoir (1980); Zumbach (1984); Ginsborg (1997) and (2001); Richards (2000); Sloan (2006); Zuckert (2007); McLaughlin (2007); Huneman (2007b); Zammito (1992), (2003), and (2007). None of these recent publications explore the relation between modern rationality and the life sciences as such.

²⁶ Kant (2003), p. ix, Preface to the first edition.

cognitions to which it strives to attain *without the aid of experience*'.²⁷ This statement is explained below, when we discuss the text of the analogy.

The political relevance of, and motivation for, his work is addressed in his essay entitled 'What is Enlightenment?'.²⁸ In this essay, he describes the Enlightenment as the release of man from his 'self-incurred tutelage'. This tutelage is 'self-incurred', according to him, because man does not lack reason, but merely lacks 'resolution and courage to use it without direction from another'.²⁹ He rebels, therefore, against the predominant situation of his time where man subjected himself to the instructions and opinions of various professionals - 'experts' as they could be called today - such as doctors, teachers, and members of the clergy. The desirable situation envisaged by Kant can only be realized if a thorough explanation is offered of how reason functions; what its potential is and what its limits are.

Kant addresses the philosophical relevance of his work in the introduction to the *Critique of Pure Reason*, where he describes the troubled history of scholarship on metaphysics. He sets himself the task of rescuing metaphysics, which he calls the '*queen* of all the sciences',³⁰ from an unfortunate move from dogmatism, to anarchy, to an almost studied - but ultimately implausible - 'indifference'.³¹ His work is meant, in his own words, to provide once and for all 'the solution of the question regarding the possibility or impossibility of Metaphysics, and the determination of the origin, as well as of the extent and limits of this science.'³²

The scientific justification for his work lay in the ambition to address metaphysics with the kind of scientific rigour displayed by the physical laws that Copernicus and Newton had proposed, without at the same time committing the errors that they had committed.³³ This ambition was most famously formulated in Kant's representation of his work on pure reason as a 'Copernican revolution' in metaphysics:

We should then be proceeding precisely on the lines of Copernicus' primary hypothesis. Failing of satisfactory progress in explaining the movements of the heavenly bodies on the supposition that they all revolve around the spectator, he tried whether he might not have better success if he made

²⁷ Ibid.

²⁸ Kant (1963).

²⁹ Ibid., p. 3.

³⁰ Kant (2003), p. vii.

³¹ Ibid., p. viii.

³² Ibid., p. ix.

³³ Müller-Sievers (1997), p. 2.

the spectator to revolve and the stars to remain at rest. A similar experiment can be tried in metaphysics, as regards the intuition of objects. If intuition must conform to the constitution of the objects, I do not see how we could know anything of the latter a priori; but if the object (as object of the sense) must conform to the constitution of our faculty of intuition, I have no difficulty in conceiving such a possibility.³⁴

With this brief background of the motivations that lie behind the *Critique of Pure Reason*, we now turn to the substance of his ideas before addressing the text of the analogy itself.

1.2.3 *The first Critique*

In the *Critique of Pure Reason* Kant was concerned to inquire into the possibility of understanding without recourse to our experience of the world. Kant was not an empiricist: he did not believe that reason or understanding could be deduced from experience. As Kant says: ‘though all our knowledge begins with experience, it by no means follows that all arises out of experience.’³⁵ Kant proposes that we, as humans, know the world - or rather that we ‘cognize’ it, which does not mean that we *actually* know it - through principles of understanding that are *prior* to experience. This reason is described by Kant as ‘pure reason’. He says: ‘Our ability to cognize from a priori principles may be called *pure reason*, and the general inquiry into the possibility and bounds of such cognition may be called critique of pure reason.’³⁶ According to Kant, it is therefore not experience that makes reason possible, but the other way around. It is reason that makes our experience of objects in the world possible.

In order to establish his idea of pure reason, Kant seeks to provide an answer to the question ‘whether there exists a knowledge altogether independent of experience, and even of all sensuous impressions?’³⁷ He calls this kind of knowledge ‘*a priori*, in contradistinction to empirical knowledge, which has its sources *a posteriori*, that is, in experience’.³⁸ The question that guides him in his inquiry is therefore not ‘how is the *faculty of thought* itself possible’.³⁹ Rather, the question is how can a reason exist that is prior to experience and that nevertheless corresponds to it? This idea of correspondence can be regarded as a ‘thin’ one, since Kant believes that our concepts do not actually determine

³⁴ Ibid., p. 1, citing Kant.

³⁵ Kant (2003), p. 1.

³⁶ Kant (1987), p. 3.

³⁷ Kant (2003), p. 1.

³⁸ Ibid.

³⁹ Ibid., p. xi.

objects in the world. Although we need concepts in order to ‘cognize’ objects in the world, we cannot actually know these objects through them. As Kant sees it, there are two possible explanations for the existence of this correspondence:

[T]here are only two possible ways in which synthetical representation and its objects can coincide with and relate necessarily to each other, and, as it were, meet together. Either the object alone makes the representation possible, or the representation alone makes the object possible. In the former case, the relation between them is only empirical, and an *a priori* representation is impossible ... In the latter case - although representation alone ... does not produce the object as to its existence, it must nevertheless be *a priori* determinative in regard to the object, if it is only by means of the representation that we can cognize anything as an object.⁴⁰

This idea of the existence of correspondence between thought and objects in the world would be challenged in the twentieth century. As Heidegger pointed out, it was Kant who first gave this idea its philosophical grounding.⁴¹ Although Kant represents the work he elaborates in the three *Critiques* as concerning the ‘cognitive powers’,⁴² i.e. understanding (addressed in the *Critique of Pure Reason*), reason (addressed in the *Critique of Practical Reason*), and judgment (addressed in the *Critique of Judgment*), it would be a mistake - according to Heidegger - to represent his work as a ‘theory of knowledge’.⁴³ Heidegger points out that Kant’s theory necessarily implies the question of the possibility of ontology and the question of anthropology, even if Kant does not elaborate much on either.⁴⁴

1.2.4 The appearance of the analogy

The analogy in question appears in the chapter of the *Critique of Pure Reason* entitled ‘Of the Deduction of the Pure Conceptions of the Understanding’.⁴⁵ This is the most important part of the *Critique* because it is here that Kant explains the foundations of his philosophy of understanding. Kant proposes the idea of the ‘categories’ as *a priori* principles of understanding. The categories are, simply put, the intellectual tools which exclusively make the world intelligible to us. This does not mean that they make the world knowable for us. Rather, it means that any experience and thought that we have of or about the world is

⁴⁰ Ibid., pp. 72-73.

⁴¹ Heidegger (1997), p. 8.

⁴² Kant (1987), p. 4.

⁴³ Heidegger (1997), p. 11.

⁴⁴ Ibid., pp. 8-11 and 144.

⁴⁵ Kant (2003), pp. 68-96.

necessarily made possible by, and mediated through, these categories. Kant took the idea of the categories from Aristotle but revised them to suit his own purposes.⁴⁶

How do we have access to these categories; where do they come from? Kant said that his own mind provided him with his research object:

[I] confine myself to the examination of reason alone and its pure thought; and I do not need to seek far for the sum-total of its cognition, because it has its seat in my own mind. Besides, common logic presents me with a complete and systematic catalogue of all the simple operations of reason.⁴⁷

Although Kant's own mind represents the 'raw material' for his study of reason, this does not mean that the categories should be regarded as subjective or specific to one's own cognition. Kant sought to offer an absolute and universal description of the functioning of reason; his categories are both *a priori* and necessary. Therefore, although reason is present in each human being, and defines human beings as such, it is not particular to each individual with regard to its functioning.

Kant must establish the categories, or conceptions of understanding, as existing prior to experience and independently of it precisely because they make experience possible: 'The whole aim of the transcendental deduction of all *a priori* conceptions is to show that these conceptions are *a priori* conditions of possibility of all experience.'⁴⁸ His effort to somehow 'deduce' the categories, but not from experience, can be regarded as an effort to give his theory scientific credibility.⁴⁹ It is at this point, the point where he must explain the appearance or deduction of the categories, that the analogy appears.

1.3 Different scenarios

1.3.1 Three biological processes

Kant proposes three different scenarios for the emergence of the categories as *a priori* principles that can, nevertheless, make the world intelligible to us. First, the categories originate from experience. Second, the categories did not originate from experience but

⁴⁶ Ibid., pp. 61-62.

⁴⁷ Ibid., p. x.

⁴⁸ Ibid., p. 73.

⁴⁹ Müller-Sievers (1997), p. 2.

make experience possible. Third, there is a natural harmony or correspondence between the world and the categories. Kant explains these three scenarios with reference to three different biological processes.⁵⁰

The first is *generatio aequivoca*; a theory that proposes that life emerges spontaneously from inert matter. Kant compares this to the emergence of the categories from experience. Such an emergence would explain the correspondence between the categories and experience. However, it necessarily follows that the categories would not be *a priori*. Kant believes that experience is made possible by understanding. This means that understanding cannot possibly emerge from experience because it exists prior to - and separate from - it. Since *generatio aequivoca* was already regarded as an antiquated theory at the time of Kant's writing he probably used this analogy to represent the ideas of empiricists as obsolete.⁵¹

The third scenario is preformation. Kant describes this as the 'middle way' between epigenesis (discussed below) and *generatio equivoca*. The correspondence between the categories and the world is explained through the idea of a natural harmony between understanding and experience. Such pre-existing harmony can only be explained by reference to a Creator. However, this scenario cannot account for the necessary and *a priori* character of the categories. More importantly, Kant seeks to avoid references to the 'supernatural',⁵² because they negate the necessity and possibility of his own project: the inquiry into reason by reason. This explanation of the emergence of the categories would undermine Kant's idea of reason as autonomous.

The difficulties of both the first (*generatio aequivoca*) and third (preformation) scenarios lead Kant to choose the second scenario. Kant compares the emergence of pure reason with 'as it were, ... the *Epigenesis* of pure reason'.⁵³ In order to understand this seemingly curious analogy, it is necessary to notice what Kant understands by epigenesis. This biological theory was very much in development at the time of Kant's writing. Although its precise meaning remains unclear, both in Kant's work and in the life sciences,⁵⁴ it seems that epigenesis was generally regarded as a process of self-generation and gradual development. One strand of thought, represented by the earlier works of the German

⁵⁰ See para. 1.2.1 above for the text of the analogy.

⁵¹ Müller-Sievers (1993), p. 50, n. 77.

⁵² Kant (1987), p. 311, section 81, para. 424.

⁵³ Kant (2003), p. 95.

⁵⁴ Zammito (2007), p. 52.

scientist Blumenbach, regarded epigenesis as a process developing out of ‘germs’ or ‘predispositions’ (see para. 1.3.6. below). Another, represented by the later works of Blumenbach, described epigenesis as a rather unbridled self-generative force.⁵⁵

1.3.2 Between clarification and distraction

The use of models and metaphors in - and from - the life sciences is well known. However, the significance attributed to such metaphors or models differs according to how metaphors in general are regarded. Roughly, some believe that metaphors are a means to describe certain phenomena in a way that makes these phenomena more understandable without having any effect on the phenomena described. Others believe that metaphors are more significant, since they not only translate certain beliefs of a particular period in time but also give further content to the phenomena of which they merely seem to provide a description.

There are numerous examples of research that propose the latter and discuss specific metaphors in detail in order to explore what they facilitate, represent, and make possible.⁵⁶ The potential meaning and effect of the epigenesis analogy is conditioned by the use of analogy in Kant’s work more generally. Kant himself regarded the use of metaphors and analogies as involving a ‘transference of reflection’.⁵⁷ By this he meant that a metaphor or analogy can be useful in the situation where a concept does not directly correspond with a certain object. A metaphor or analogy can provide clarification by reflecting on such an object laterally, so to speak.

The analogy that is at issue only appeared in the second edition of the *Critique of Pure Reason*. Perhaps Kant resorted to this analogy in order to respond to criticisms, raised by readers of the first edition, with regard to the intelligibility of his remarks on the emergence of the categories.⁵⁸ However, such an explanation may not be satisfactory. His rather obscure analogy to biological processes without any further elaboration defeats any intention of clarification that he might have had. After all, it can be assumed that not all of his readership was as well versed in the life sciences of his time as he was. It is clear,

⁵⁵ Sloan (2002), p. 247.

⁵⁶ Canguilhem (2002), pp. 305-318; Fox Keller (1995), (2000a), and (2002); Kay (2000); Tauber (1994).

⁵⁷ Zöllner (1988), p. 71, citing Kant.

⁵⁸ Ingensiep (1994), p. 386; Zöllner (1988), p. 75.

however, that Kant was disappointed by the muted response to the first edition of the *Critique of Pure Reason*. He attributed the apparent difficulty that readers had in grasping his ideas to his own 'lack of stylistic elegance'.⁵⁹

It is also clear that he struggled most with the writing of this particular section of the work. As he himself says in the introduction:

[I] know no investigations more necessary for a full insight into the nature of the faculty which we call *understanding*, and at the same time for the determination of the rules and limits of its use, than those undertaken in the second chapter of the Transcendental Analytic, under the title of *Deduction of the Pure Conceptions of the Understanding*; and they have also cost me by far the greatest labor.⁶⁰

Not only did the elaboration of his ideas in this particular part of the work cost him 'by far the greatest labor', he also struggled with how best to clarify his ideas. In the same introduction he addresses, rather extensively, his doubts and deliberations on whether or not - and if so to what extent - to resort to illustrations and examples. He says:

[A]s regards *clearness*, the reader has a right to demand, in the first place, *discursive* or logical clearness, that is, on the basis of conceptions, and secondly, *intuitive* or aesthetic clearness, by means of intuitions, that is, by examples or other modes of illustration *in concreto*. I have done what I could for the first kind of intelligibility. This was essential to my purpose; and it thus became the accidental cause of my inability to do complete justice to the second requirement. I have been almost at a loss, during the progress of this work, how to settle this question.

Examples and illustrations always appeared to me necessary ... But I very soon became aware of the magnitude of my task, and the numerous problems with which I should be engaged; and, as I perceived that this critical investigation would ... be far from being brief, I found it inadvisable to enlarge it still more with examples and explanations, which are necessary only from a *popular* point of view ... For explanations and examples, and other helps to intelligibility, aid us in the comprehension of *parts*, but they distract the attention, dissipate the mental power of the reader, and stand in the way of his forming a clear conception of the *whole*.⁶¹

With this in mind, it could be argued that the necessity of making the core of his theory understood made him overcome his initial reluctance to resort to analogy. Perhaps it was his fear of enlarging his work too much and of 'dissipating the mental power of the reader' by distracting him from the systematic structure of his work, that prevented him from further elaborating on his chosen analogies.

It is perhaps interesting to briefly contrast Kant's anxiety over the use of metaphors and analogies with Nietzsche's statement: 'What, therefore, is truth? A mobile army of

⁵⁹ Zammito (1992), p. 9.

⁶⁰ Kant (2003), p. xi.

⁶¹ *Ibid.*, pp. xii-xiii.

metaphors, metonymies, anthropomorphisms'.⁶² Nietzsche says that '[e]very idea originates through equating the unequal'.⁶³ In other words, metaphors and analogies should not merely be regarded as 'examples' or 'illustrations' as Kant suggested. Rather, they give rise to - and shape - the actual substance of a theory. The irresistible attraction that analogy and metaphor represented for Kant, and which he apparently fought to resist, is for Nietzsche an expression of a 'fundamental impulse' of the intellect: 'that impulse towards the formation of metaphors, that fundamental impulse of man, which we cannot reason away for one moment - for thereby we should reason away man himself'.⁶⁴

1.3.3 *The life sciences at the time*

Regardless of Kant's motivations for including the analogy, what should we make of it? Was the analogy merely meant to provide an illustration of his ideas, or does it give additional substance to what it was supposed only to elucidate? Many commentators have debated the plausibility and significance of the epigenesis analogy.⁶⁵ Most argue that it should be seen only as a means of explanation. It is emphasized that no parallels can, or should, be drawn between Kant's philosophical ideas and the biological theory of epigenesis. To attribute any substantial significance to the analogy would be misguided, because it would confuse the two distinct realms of biological ontology and the 'ontology' of reason.⁶⁶ This criticism seems obviously correct when one remains faithful to Kant. No one, it seems, would truly dispute that the realms of biology and reason are distinguished. This distinction is, after all, what defined Kant's philosophy.

However, there are reasons for attributing more significance to the analogy, if only because it appears at such a crucial stage in his theory. Although it is regarded as 'merely' an analogy and its precise meaning remains elusive,⁶⁷ this does not foreclose the possibility that the choice for this analogy is itself indicative of the kind of theory that Kant sought to establish.⁶⁸ Therefore, no matter what opinion one holds, and no matter how dubious one

⁶² Derrida (1997), cited in the translator's Preface, p. xxii.

⁶³ Ibid.

⁶⁴ Ibid.

⁶⁵ See n. 24 above.

⁶⁶ Most clearly formulated by Ingensiep (1994), p. 385.

⁶⁷ Müller-Sievers (1997), p. 13, that Kant uses the words 'as it were' shows that it is for him 'nothing more, but also nothing less, than an analogy'.

⁶⁸ Zammito (2006), p. 761: 'can this matter be *left* at the level of mere analogy? Logically, analogy postulates at least *some* common concept under which two quite different matters can be subsumed, some correspondence at least in terms of a *relation*'; Sloan (2002), p. 252.

deems the analogy to be, its use seems to illuminate Kant's ideas about the relation between reason and life.

Kant's references to biological processes may seem unusual. However, references to the life sciences are scattered throughout his work; it seems that he was rather well informed of developments in the sciences of his time. Particular importance has been attached to the apparent mutual influence between Kant and Blumenbach.⁶⁹ Opinions diverge on whether or not Kant's ideas actually influenced the scientists of his period. Views also differ on how Kant made use of certain theories; some believe that he adapted them to suit his own ends.⁷⁰

Biology as a discipline particularly concerned with life or living processes was very much in development at the time when Kant wrote his three *Critiques*. It was only at the end of the eighteenth century that a 'unified theory of life and its history' was first envisioned.⁷¹ Foucault famously remarked that the notion of 'life' did not exist before that time; only beings that were the subject of classification.⁷² The tentative theory was given many different names, such as '*zoologie générale*', '*zoonomie*', '*organology*', and - finally - '*biologie*'; it was only in 1802 that the term 'biology', proposed by Jean Baptiste Lamarck and Gotthelf Reinhold Treviranus, emerged.⁷³ The focus of the new discipline was on 'the different forms and phenomena of life, the conditions and laws of their existence as well as the causes that determine them'.⁷⁴ But almost from the moment of the emergence of biology as a discipline various specialized subdisciplines developed. Since each of these disciplines focused on different aspects of living processes, the initial project of a 'unified theory of life' arguably remained elusive from its very beginning.⁷⁵

⁶⁹ Lenoir (1980) believes there was a genuine mutual influence; Richards (2000) speaks of a 'common misunderstanding', p. 12; Steigerwald (2002), pp. 98-100.

⁷⁰ Richards (2000), p. 32. Another subject of disagreement is whether or not Kant's writings have anything to contribute to the contemporary life sciences. Some argue for Kant's relevance: Walsh (2006), specifically with regard to Kant's idea of organisms as 'natural purposes'. Others argue against: Zammito (2006), p. 749 and p. 755 discussing Kant's 'epistemological "deflation"' of the life sciences and referring to Kant's statement that there will never be a 'Newton of the blade of grass'; Richards (2000), pp. 26-27.

⁷¹ Lenoir (1982), p. 1.

⁷² Foucault (2004), pp. 139 and 173.

⁷³ Lenoir (1982), p. 1; Jacob (1976), p. 87.

⁷⁴ Lenoir (1982), p. 1, citing Treviranus.

⁷⁵ *Ibid.*, p. 1.

1.3.4 The meaning of the analogy

Although there is disagreement as to the meaning that should be attributed to the epigenesis analogy, most authors agree that it was not Kant's intention to 'naturalize' the categories or give them a biological foundation. Kant probably used epigenesis to avoid the other two origin scenarios that he considered implausible.⁷⁶ However, he also recognizes the productive characteristics of the theory of epigenesis; as he observed in the *Critique of Judgement*:

[C]onsider, on the other hand, *epigenesis* ... reason would from the start be greatly in favor of the kind of explanation [it offers]. For in considering those things whose origin can be conceived only in terms of a causality of purposes, this theory ... regards nature as itself producing them rather than as merely developing them; and so it minimizes appeal to the supernatural, [and] after the first beginning leaves everything to nature.⁷⁷

Kant seems to associate the characteristics of epigenesis with the characteristics of his particular idea of Pure Reason. He describes this reason as not originating in, or dependent on, either experience or God. Rather, reason includes its own origin.⁷⁸ This idea of an autonomous, and to a certain extent self-sufficient, reason is shaped through the analogy to epigenesis. Müller-Sievers suggests that the self-generative character of epigenesis probably appealed to Kant because it enabled him to represent reason as autonomous.⁷⁹

If this line of argument is followed, then the analogy to epigenesis can be regarded as playing a significant role in the justification of his philosophy and as supporting the claim to its universal validity. It has been pointed out, in this respect, that Kant intentionally draws upon the particular appeal of the organic which - traditionally - carries with it its own justification or at least a certain measure of inevitability.⁸⁰ In these terms, the epigenesis analogy was instrumental in establishing the unity and self-sufficiency of the pure reason that Kant is proposing.⁸¹ It has been pointed out that, even if Kant appeals to the organic to benefit his theory, this theory itself and the structure of the Kantian system as a whole 'remains architectonic, not organic'.⁸² What does the term 'architectonic' mean in relation to Kant's philosophy?

⁷⁶ Müller-Sievers (1993), p. 55.

⁷⁷ Kant (1987), pp. 310-311, section 8, para. 424.

⁷⁸ Müller-Sievers (1993), p. 56.

⁷⁹ Ibid., pp. 55-56; Müller-Sievers (1997), p. 4.

⁸⁰ Müller-Sievers (1997), p. 4.

⁸¹ Foucault (1984), p. 36: This self-sufficiency is described by Foucault as 'a use of reason in which reason has no other end but itself: *rasonieren* is to reason for reasoning's sake'.

⁸² Müller-Sievers (1997), p. 13.

1.3.5 *The architectonic and the organic*

The term ‘architectonic’ itself did not originate with Kant, but has a long philosophical history that dates back to Leibniz and Aristotle.⁸³ It has been suggested that Kant’s specific use of the term was influenced by Lambert and, indirectly, Baumgarten. The latter used it with reference to ontology while the former proposed that it could be used to solve ‘methodological problems’ to which the relation between metaphysics and the sciences gives rise.⁸⁴ The philosophical tradition of the term is important. It does not merely represent an analogy to architecture or construction, although Kant likens the structure of his philosophy at times to that of a building.⁸⁵ As Aristotle pointed out:

the true object of architecture is not bricks mortar or timber, but the house; and so the principal object of natural philosophy is not the material elements, but their composition, and the totality of the form to which they are subservient, and independently of which they have no existence.⁸⁶

Kant emphasized the architectonic structure of his philosophy in order to represent it as a purposeful ‘whole’: ‘By the term *Architectonic* I mean the art of constructing a system. Without systematic unity, our knowledge cannot become science; it will be an aggregate, and not a system.’⁸⁷ The idea of the ‘system’ and the ‘whole’ are important in Kant’s philosophy. The representation of his philosophy as an integrated ‘whole’ can be regarded as representing the German philosophical tradition of the *philosophia generalis* that was meant to defend philosophy as a discipline in its own right from other disciplines such as law, medicine, and the natural sciences.⁸⁸

More importantly, the representation of his philosophy as a systemic unity that is self-organizing and self-contained mirrors Kant’s description of the organism. In other words, pure reason and the organism are both represented as integrated ‘systems’.⁸⁹ Kant refers more frequently to the empirical diversity of nature than to the ‘organic’ as such. Although the architectonic and the organic can be distinguished in Kant’s philosophy, they are representative of the same systemicity. It is interesting to observe, at this point, that Heidegger associated the notion of the system with the emergence of the particular

⁸³ Caygill (1995), pp. 84-85.

⁸⁴ Manchester (2003), p. 195.

⁸⁵ Manchester (2003), p. 189-191.

⁸⁶ Aristotle (1987), p. 17, I.5, para. 645a.

⁸⁷ Kant (2003), p. 466 (‘The Architectonic of Pure Reason’).

⁸⁸ Caygill (1995), p. 85.

⁸⁹ Zammito (2006), p. 761.

metaphysics that characterizes modernity (referred to by Heidegger as ‘the age of the world picture’).⁹⁰ After this brief interlude we now turn to the potential consequences of the epigenesis analogy.

1.3.6 *Unintended consequences*

If Kant used the analogy to epigenesis, as has been suggested, in order to allow his theory to benefit from its self-generative character then the use of the analogy also had some unintended consequences. One is that the representation of reason as an autonomous or self-sufficient process suggests a reason that is both dogmatist and despotic, as Foucault suggested.⁹¹ However, perhaps the most important unintended consequence of the use of the analogy is that - although epigenesis helps to establish the autonomy of reason - the idea of self-generation associated with it also threatens this autonomy and ultimately undermines the conceptual coherence of Kant’s system.⁹² If epigenesis is regarded as a productive, self-generative process, it is necessarily immune to the distinction between experience and cognition that Kant proposes. Indeed, it could potentially cause such distinctions to dissolve.

It has been argued that Kant foresaw these consequences and therefore limited the creative force of epigenesis by describing the categories as developing somehow from pre-existing ‘germs’ (*Keime*) and ‘dispositions’ (*Anlage*).⁹³ In a passage that precedes his introduction of the analogy and which addresses *a priori* concepts, Kant observes that ‘the pure concepts of the understanding are to be “followed to their first *Keime und Anlagen* in the human understanding where they lie prepared”’.⁹⁴ It has been suggested that his reference to both germs and predispositions represents a kind of ‘middle way’ between preformationism and epigenesis.⁹⁵

Kant liked Blumenbach’s idea of the *Bildungstrieb*, which he acknowledged as having influenced his own idea of epigenesis, to the extent that it represented an ‘epigeneticism

⁹⁰ Heidegger (1977), p. 141.

⁹¹ Foucault (1985), p. 7.

⁹² Zammito (2003), pp. 96-97; Sloan (2002), p. 245; Huneman (2006), p. 654.

⁹³ Sloan (2002), p. 238.

⁹⁴ *Ibid.*, p. 241.

⁹⁵ *Ibid.*, p. 238.

within the limits of simple reason'.⁹⁶ However, Blumenbach - at least in his later work - did not impose any limits on epigenesis as a formative power. It can, therefore, be argued that Kant restricted the self-generative capacities of reason in his first *Critique* with the aim of safeguarding the architectonic and systematic structure of his theory of pure reason.⁹⁷

Perhaps the potential negative effects of the epigenesis analogy for Kant's theory are neutralized by the very nature of the theory that he proposes. He is, after all, not introducing life or epigenesis into his system. Rather, the process of epigenesis that he refers to remains an object of the understanding and cannot be identified with the biological process itself.⁹⁸ However, even if this is the case, the epigenesis analogy still seems to reveal a problem at the heart of Kantian theory, that is, how can the boundary between experience and understanding or between life and the knowledge of life be maintained?

Above, we discussed how Kant refers to biological processes in order to establish his system of pure reason. However, this only represents one part of the relation between reason or knowledge and life that Kant proposes. The other part, I argue, is represented by what Kant calls the 'lawfulness of the contingent'.⁹⁹ In what follows, the meaning of this idea and its effects are discussed. I argue that it is the combination of these two parts of his theory - the epigenesis analogy and the lawfulness of the contingent - that have come to define the relationship between life and knowledge that still haunts writings in the life and social sciences today.

⁹⁶ Huneman (2006), p. 655, citing Blumenbach.

⁹⁷ See n. 92 above.

⁹⁸ Ingensiep (1994), p. 393.

⁹⁹ For example, Kant (1987), first Introduction to the *Critique of Judgment*, p. 405, section VI, para. 217': 'a lawfulness that [something] contingent [may] have [insofar] as [it] is contingent'; p. 432, section XI, para. 243': 'a lawfulness that is contingent objectively but necessary subjectively'; p. 417, para. 228': 'the lawfulness of an intrinsically contingent connection of the manifold in the object'. See also Ginsborg (1997), p. 339 and Zuckert (2007), pp. 5-7.

PART II

2.1 The third *Critique*

2.1.1 The 'lawlikeness of the contingent'

It was discussed above that Kant relied on an analogy to a biological process not only to explain his idea of pure reason but also to further shape the autonomous and self-generative character of this reason. However, this use of the life sciences in order to establish knowledge or reason represents only one part of Kant's system. The other part can be found in his third *Critique*: the *Critique of Judgment* (*Kritik der Urteilskraft*) written in 1790.¹⁰⁰ Having set out his system of theoretical cognition by addressing the first two cognitive powers in the first two *Critiques*, Kant now seeks to complete his inquiry into theoretical cognition by addressing what he regards as the third cognitive power: judgment.

The third *Critique* fills the gap that was left by the first two, or - in Kant's own words - 'judgment, which in the order of our [specific] cognitive powers is a mediating link between understanding and reason'.¹⁰¹ However, the power of judgment is not merely a 'link' but represents a necessary element of Kant's system:

[T]he categorical principles are laws governing all of nature, necessarily, and are such because they are necessary conditions for our knowledge of nature and for the possibility of experience. But ... they are not sufficient conditions for either: they do not provide knowledge of the given, particular character of objects, nor do they guide us as to how we ought to discern some order in nature with respect to those characteristics. And yet, unless we have some way of ordering the diversity in nature, we will have no knowledge of nature beyond that the categorical principles apply to it.¹⁰²

The *Critique of Judgment* consists of two sections, namely the 'Critique of Aesthetic Judgment' and the 'Critique of Teleological Judgment'. The former deals with judgment regarding beauty, while the latter addresses judgment in relation to natural processes. Most of the commentaries that have been written on the third *Critique* focus on aesthetic judgment. The *Critique of Judgment* is often regarded as the least doctrinal and, perhaps for that same reason, as the most interesting of the three *Critiques*. It also seems to put Kant's project, which he elaborated in the first two *Critiques*, into question. The focus on judgment and on the reflective, rather than constitutive, principle of purposiveness that

¹⁰⁰ Kant (1987).

¹⁰¹ Ibid., Preface to the first edition, p. 5, para. 168.

¹⁰² Zuckert (2007), p. 12.

makes judgment possible introduces or reveals a measure of contingency that was obscured by the abstract and universal character of the categories.¹⁰³

As opposed to the epigenesis analogy, which can be located quite specifically within the first *Critique*, the idea of the ‘lawlikeness of the contingent’ or a ‘lawlikeness without a law’ (*‘Gesetzmässigkeit ohne Gesetz’*) traverses the entire *Critique of Judgment*.¹⁰⁴ In fact, it has been argued that it is the principle of purposiveness, more generally, that unites the two parts of the *Critique of Judgment* and makes it into a ‘whole’.¹⁰⁵ The principle of purposiveness is specific to the third *Critique* and differs from the principles set out in the *Critique of Pure Reason*, because it is subjective and reflective whereas the principles of understanding are objective and universal. As Kant said of the principle of purposiveness: ‘This concept belongs to reflective judgment, not to reason, because the purpose is not posited in the object at all, but is posited solely in the subject: in the subject’s mere power to reflect.’¹⁰⁶

It is important to note that the principle of purposiveness, contrary to what its name would suggest, does not have a purpose. It performs a certain role, of course, but it cannot be regarded as having a specific goal. Kant proposes this principle specifically as an alternative to the traditional idea of a teleological principle. The principle of purposiveness *must* lack purpose in order to perform its function of making living processes intelligible:

[I]n order to explain how the subject can represent a unity of diversity, the subject must be understood as judging *purposively* without a purpose, or ... as engaged in a future-directed anticipation of an indeterminate, non-conceptually ordered whole.¹⁰⁷

It has been noted that the attribution of a sense of anticipation to the judging subject necessarily introduces contingency and temporality into the notion of the subject itself that was previously regarded, in the first two *Critiques*, as a largely ‘atemporal’ form that anchored the principles of understanding.¹⁰⁸ We will now inquire further into the character of the principle of purposiveness in order to unveil how living processes are included in the Kantian system by excluding them from reason.

¹⁰³ Ibid., pp. 6-7 and 11.

¹⁰⁴ G. Rose (1984), p. 17.

¹⁰⁵ Zuckert (2007), pp. 4-5.

¹⁰⁶ Kant (1987), p. 404, section V, para. 216’.

¹⁰⁷ Zuckert (2007), p. 5.

¹⁰⁸ Ibid., p. 16.

2.1.2 Including through excluding

Canguilhem observed the following with regard to Kant's third *Critique*:

[I]n the eighteenth century, Kant identified the conditions of possibility of physical science with the transcendental conditions of knowledge in general. This identification found its limit, at the time of the *Critique of Judgment* (second part: Critique of Teleological Judgment), in the recognition of the fact that organisms are totalities whose analytic decomposition and causal explanation are subordinated to the use of a certain idea of finality that determines all research in biology.¹⁰⁹

As Canguilhem suggests, Kant seeks to account in the third *Critique* for living processes that cannot be cognized through the categories. Kant needs to include such processes in his theory of understanding in order to ensure the completeness of his system and does so - perhaps paradoxically - by excluding them from the idea of reason that he set out in his first *Critique*. The reason for such exclusion is that, according to Kant, natural processes (as well as beauty) cannot be understood through the constitutive principles of the categories. They can only be judged through regulative or reflective principles of judgment. Such principles of judgment serve at least two specific purposes in Kant's system:

they serve, in part, to restrain the understanding's arrogant claims, namely, that (since it can state a priori the conditions for the possibility of all things it can cognize) it has thereby circumscribed the area within which all things in general are possible; in part they serve to guide the understanding, in its contemplation of nature, by a principle of completeness - though the understanding cannot attain this completeness - and so further the final aim of all cognition.¹¹⁰

Kant explains the difference between determinative or constitutive principles of reason and regulative or reflective principles of judgment as follows:

Judgment in general is the ability to think the particular as contained under the universal. If the universal (the rule, principle, law) is given, then judgment, which subsumes the particular under it, is *determinative* ... But if only the particular is given and judgment has to find the universal for it, then this power is merely *reflective*.¹¹¹

It must be pointed out that Kant's reference to 'law', whether regarded as universal in the sense of the categories or as empirical with regard to living processes, does not necessarily refer to a law with a juridical character (although he describes his project in the *Critique of Pure Reason* initially through a legal metaphor).¹¹² Rather, laws are regarded - simply put -

¹⁰⁹ Canguilhem (2002), p. 148 (my translation).

¹¹⁰ Kant (1987), p. 4, paras. 167-168.

¹¹¹ Ibid., pp. 18-19, para. 179.

¹¹² Kant (2003), p. ix: 'It is, in fact, a call to reason, again to undertake the most laborious of all tasks - that of self-examination, and to establish a tribunal, which may secure it in its well-grounded claims, while it pronounces against all baseless assumptions and pretensions, not in an arbitrary manner, but according to its

as regularities that make cognition possible or as that which signals the potential ordering of that which is empirically diverse or contingent. The categories are not applicable to natural processes, because there is no given rule or law under which such processes may be subsumed. There are only empirical *particularities* in nature that are not always *regularities* (and even if they are, this does not automatically render them subject to the categories of understanding). Living processes are, therefore, necessarily interpreted through a reflective principle that opens up a 'space' for judgment.¹¹³

Kant proposes that judgment itself provides us with the principle that makes it possible for us to judge - rather than cognize - living processes: 'so judgment itself must provide a concept, a concept through which we do not actually cognize anything but which only serves as a rule for the power of judgment itself'.¹¹⁴ This self-reflexive principle of judgment enabling judgment is the principle of 'purposiveness'.

At first glance, it seems to resemble the traditional idea of teleology proposed by Aristotle. However, whereas traditional teleology attributes a purpose or *telos* to natural processes themselves, Kant's principle of purposiveness does not presume anything regarding the character of living processes. It is merely a principle that allows us to judge such processes: 'although we thus speak of nature *as if* the purposiveness in it were intentional, we are not *attributing* an intention to nature.'¹¹⁵ He continues:

[T]here is clearly a big difference between saying that certain things of nature, or even all of nature, could be produced only by a cause that follows intentions in determining itself to action, and saying that *the peculiar character of my cognitive powers* is such that the only way I can judge [how] those things are possible and produced is by conceiving, [to account] for this production, a cause that acts according to intentions, and hence a being that produces [things] in a way analogous to the causality of an understanding. If I say the first, I am trying to decide something about the object, and am obliged to establish that a concept I have assumed has objective reality. If I say the second, reason determines only [how I must] use my cognitive powers commensurately with their peculiarity and with the essential conditions [imposed by] both their range and their limits. Hence the first is an *objective* principle for determinative judgment, the second a subjective principle for merely reflective judgment and hence a maxim imposed on it by reason.¹¹⁶

The notion of 'purposiveness without a purpose' ('*Zweckmässigkeit ohne Zweck*'), unlike teleology, does not include the idea of an external purpose or vital force:

own eternal and unchangeable laws. This tribunal is nothing less than the *Critical Investigation of Pure Reason*.' Heidegger (1997) discusses why the Transcendental Deduction takes the form of a '*quaestio juris*', pp. 60-62; G. Rose (1984), p. 11.

¹¹³ Steigerwald (2002), p. 82.

¹¹⁴ Kant (1987), p. 6, para. 169.

¹¹⁵ Ibid., Translator's Introduction, p. lxxx.

¹¹⁶ Ibid., p. 280, section 75, para. 398.

[P]urposiveness *without* a purpose is an order of means-ends relations without an external purpose; it comprises *reciprocal* means-ends relations, in which each part is both means and end, in relation to the other parts. Thus purposiveness without a purpose is the form of fully systematic, internal relations.¹¹⁷

It is this particular idea of an almost self-contained purposiveness that makes it possible for us to regard an organism as a ‘whole’ or a ‘system’; it also inspires later theories of cybernetics and autopoiesis (see Chapter 5, para. 2.2.2).

2.2 The unification of the manifold

2.2.1 The principle of purposiveness

It is the regulative or reflective principle of purposiveness that, according to Kant, makes natural processes intelligible to us. Purposiveness is not attributed to the living process itself but is merely used by the subject in order to judge such a process (or work of art). However, we still do not know how the principle of purposiveness operates. Kant explains this by describing purposiveness as ‘the *lawfulness of an intrinsically contingent connection of the manifold* in the object’.¹¹⁸ Although this perhaps sounds rather contemporary, it is obviously a very obscure statement. What does he mean by this ‘lawfulness of the contingent’?

What Kant means is that the principle of purposiveness allows us to represent the diversity of nature’s processes as a lawlike unity. In other words, it allows us to judge natural processes ‘as if’ we were able to subsume them under a universal law through the categories. Or, again differently put, it allows us to judge natural processes as if they were not living processes at all but any other kind of object in the world that we can rationally understand. We, therefore, cannot know the living as *vivant* - in Canguilhem’s terms - but only as a ‘rational analog’ of the living.¹¹⁹ However, just as the categories do not make it possible for us to know an object, so the principle of purposiveness does not make it possible for us to know or understand living processes. In that sense, the regulative

¹¹⁷ Zuckert (2007), p. 15.

¹¹⁸ Kant (1987), p. 417, para. 228’.

¹¹⁹ Zammito (2003), p. 98.

principle and the categories function alike: both form part of theoretical cognition and neither claims anything with regard to the objects of cognition.

Perhaps the main function of the principle of purposiveness is to account for the particular and the contingent in a system that excludes such contingency and particularity from knowledge.¹²⁰ It also provides our only hope of somehow making sense of nature's diversity. As Kant says:

we need only consider the magnitude of the task ... of making coherent experience out of given perceptions of nature even though this nature could contain an infinite diversity of empirical laws ... there is required ... that nature also have a certain order in its particular rules - rules that the understanding can come to know only empirically and that, as far as it is concerned, are contingent. [But since] without these rules there would be no way for us to proceed from the universal analogy of a possible experience as such to the particular one, the understanding must think of these rules as laws (i.e., as necessary) - even though it does not cognize, nor could ever see, their necessity - for otherwise such laws would not form an order of nature. Hence, though the understanding cannot determine anything a priori with regard to these (objects), still it must, in order to investigate these empirical so-called laws, lay an a priori principle at the basis of all reflection on nature: the principle that a cognizable order of nature in terms of these laws is possible.¹²¹

When Kant speaks about the principle of purposiveness as the lawlikeness of the contingent, he does not mean that the contingent - i.e. the empirical diversity of nature - has an inherent law. Nor does he mean that we should impose a law on nature, as traditional teleology does, by ascribing a purpose to nature itself. As Kant says: 'we are neither prescribing a law to nature, nor learning one from it by observation.'¹²²

For Kant, the lawlikeness only exists for the subject. It is the subject who must presuppose a unity of nature in order to make *coherent* experience of it possible.¹²³ Therefore, even though the 'lawfulness of the contingent' sounds like a paradox, it is not: the lawfulness refers to the level of the subject whereas contingency refers to the level of the object. The lawfulness is a normative lawfulness because it describes a living process as it 'ought' to be, thus enabling the subject to judge it.¹²⁴

The principle of purposiveness also provides a solution to Kant's question of how something can be at the same time contingent and necessary. The principle provides us with 'the concept of a lawfulness that is contingent objectively but necessary subjectively (for

¹²⁰ Zuckert (2007), p. 6.

¹²¹ Kant (1987), p. 24, paras.184-185.

¹²² Ibid., p. 25, para. 186.

¹²³ Ibid., p. 23, para.184.

¹²⁴ Ginsborg (2001), p. 249.

our cognitive power)'.¹²⁵ It is contingent objectively because it concerns the particular empirical laws of biological processes. However, it is necessary subjectively for our ability to judge such processes. It is the only way in which living processes can be included in the cognition of humans, even if this does not mean that such processes can actually be known or understood through this principle.

2.2.2 *The living subject to judgment*

As described above, a living process can only be regarded as 'lawlike' or 'lawful' in the Kantian system to the extent that it conforms to - or deviates from - the normative laws of the subject. The living is judged in terms of

what an organ should do, or is supposed to do, or will do if it works correctly. We also speak of organisms and their parts as defective or malformed, of organic processes as going wrong, and of external circumstances as interfering with this or that aspect of an organism's proper functioning or development. These ways of speaking imply a commitment to normative standards governing the structure and behavior of organisms, standards that may or may not be met in a given case.¹²⁶

Normativity is, therefore, not ascribed to living processes themselves. It is the normative judgment of a subject that determines whether or not a living process conforms to the norm. However, at the same time, Kant's idea of organisms as self-generative wholes that function independent of external purpose suggests a kind of 'immanent normativity' of the living.¹²⁷ This idea of immanent normativity, which is implicit in Kant's theory, is elaborated by Canguilhem in his notion of 'vital normativity' (see Chapter 6). A similar idea of normativity is relied upon in theories of self-generation and autopoiesis where normativity is usually represented as the functioning of a system or its self-organization. Any connotation of value in relation to the normative is usually avoided in such theories,¹²⁸ contrary to Canguilhem's notion of normativity which implicitly retains this connotation.

¹²⁵ Kant (1987), p. 432, section XI, para. 243'.

¹²⁶ Ginsborg (2001), p. 251.

¹²⁷ Zammito (2006), p. 753.

¹²⁸ Ibid.: noting that even technical 'function talk' in the life sciences 'cannot get away from the question of "welfare" or "benefit"'.

2.2.3 *The unity of diversity*

The idea of a ‘lawlikeness of the contingent’ makes it possible to unify the diversity of living processes in order to make them intelligible. According to Kant, neither teleology nor mechanism succeeds in this because both theories make claims regarding the nature of living processes themselves.¹²⁹ An organism can be made intelligible by regarding it as a ‘unity of diversity’.¹³⁰ The unification of the ‘manifold’, as Kant sometimes calls it, can be achieved through the concept. It is the concept of the organism that makes it possible for an organism to be grasped as such.¹³¹

It is important to emphasize that the unification of diversity that is effected through a concept unifies the diverse *as diverse* and differs, therefore, from subsuming diversity under a universal concept or principle (as happens in understanding).¹³² It can even be said that for a unity to exist in the first place, the diverse or contingent must be maintained as such precisely because ‘parts ... *must* have the specific, empirical, diverse, contingent characters that they do, in order for each to serve its particular function towards the end of the object, to play its part in the whole’.¹³³

Kant’s unification of the manifold, perhaps paradoxically, gives rise to the reinforcement or acknowledgement of diversity and contingency. It could even be said that the ensuing unity is as much the result of differentiation as it is of unification. Nevertheless, Kant’s emphasis on the unification of the diverse can easily be mistaken as referring to the substantial or ontological unity of an individual entity. It can, therefore, come to undermine Kant’s initial intention of understanding the diverse as such. Although Kant recognizes that the diversity and contingency of living processes is unavoidable, he nevertheless regards it as a constant ‘threat’ to his system of pure reason.¹³⁴

It should be pointed out that the idea of the ‘unity of the diverse’ did not emerge for the first time in Kant’s work. It forms part of a German rationalist tradition where it is used to express the ‘superior, paradigmatic order or unity, i.e., “perfection”’ that was traditionally

¹²⁹ See also Kant (1987): Translator’s Introduction, p. lxxx.

¹³⁰ Zuckert (2007), p. 5.

¹³¹ Ginsborg (2001), p. 235; Kant (1987), p. 417, para. 228’; Heidegger (1997), p. 37.

¹³² Zuckert (2007), pp. 13-14.

¹³³ Ibid., p. 15.

¹³⁴ Ibid., pp. 25 and 48.

attributed to God.¹³⁵ So, even before Kant organisms were often regarded as ‘harmonies of multiplicity’.¹³⁶ Kant, however, transformed the notion of the ‘unity of diversity’ so that it could accommodate the contingency of a subject’s judgment (rather than the perfection associated with a supernatural force).

Luhmann observes with regard to the idea of ‘unity of diversity’:

[I]t is worth remembering Kant at this point. Kant started with the assumption that plurality (in the form of sense data) is given and that unity must be constituted (synthesized). Only separating these aspects, thus posing complexity as a problem, makes the subject into a subject - indeed, into a subject of the connection between plurality and unity, not only into a producer of synthesis. Systems theory breaks with Kant’s point of departure and therefore has no need for a concept of the subject. It replaces it with the concept of self-referential systems.¹³⁷

Although Luhmann suggests that his own systems theory ‘breaks with Kant’s point of departure’, he might be seen as continuing the German rationalist tradition through his reliance on the notion of a ‘*unitas multiplex*’.¹³⁸ Indeed, Luhmann regards autopoiesis as providing an answer to the question of how a unity of diversity can be conceived: ‘there is no other possibility of seeing unity in plurality, of synthesizing a multiplicity, of reducing complexity to unity’.¹³⁹ However, Luhmann’s unity is not a unification of diversity but a ‘unity of self-reference and external reference’.¹⁴⁰ He, therefore, focuses on the process of differentiation that necessarily underlies unification.

Kant’s idea of the unity of the diverse *as diverse* is echoed in Luhmann’s statement that the ‘unity of distinction is understood as the unity of the imaginary space of its own combination potentials’.¹⁴¹ Similarly to Kant, Luhmann emphasizes that unity ‘must be produced and that it does not exist in advance as an individual, a substance, or an idea of its own operation’.¹⁴²

¹³⁵ Ibid., p. 7.

¹³⁶ Ibid., p. 8.

¹³⁷ Luhmann (1996), p. 28.

¹³⁸ Ibid., p. 18.

¹³⁹ Ibid., p. 483.

¹⁴⁰ Luhmann (1998), p. 10.

¹⁴¹ Ibid.

¹⁴² Luhmann (1996), p. 33.

2.3 Identifying what Kant is identifying

2.3.1 *Negotiating the a priori*

I have discussed above Kant's elaboration of a particular relation between knowledge or understanding and living processes, arguing that he adopted a two-pronged approach of inclusion and exclusion of such processes from knowledge or understanding. I have argued that Kant, on the one hand, sought to explain the correspondence between understanding and experience without deriving the former from the latter. On the other hand, he sought to portray reason as autonomous and his own theory as a systematic 'whole'. But what was Kant identifying when he elaborated this problematic relation between knowledge and life? And what exactly does this relation signify?

The particular form that the relation between knowledge and life takes in Kant's work can be questioned from a variety of perspectives and through a number of different theoretical figures. For example, Kant's elaboration of this relation in the form of an inclusion through exclusion represents what Agamben calls an 'exception'.¹⁴³ The effect of such an exception is that whatever is excluded, i.e. living processes, comes to lie at the heart of that from which it is being excluded: knowledge.

With regard to knowledge or understanding itself, the relation that Kant elaborates can perhaps be regarded as an 'epistemological obstacle'¹⁴⁴ or 'epistemological boundary'.¹⁴⁵ It, then, either stands in the way of knowledge but at the same time produces it, or it represents a 'false' limit of knowledge that stimulates thought. The relation between knowledge and life could, furthermore, be regarded as the 'environment' (in Luhmann's terms) of Kant's system; as that which must somehow be integrated or continuously referred to in order to maintain the structure of his system. Finally, the relation that Kant establishes can be regarded as a Foucauldian 'diagram' because it seems to impose a new kind of truth or reality.¹⁴⁶

¹⁴³ Agamben (1998), p. 9.

¹⁴⁴ Lecourt (1975), pp. 135-136; Gutting (1989), pp. 16 and 41: a Bachelardian concept that was refined by Canguilhem. Whereas Bachelard portrayed it as an obstacle for the development of knowledge, Canguilhem regarded such obstacles at the same time as productive (see Chapter 5, para. 3.2.3).

¹⁴⁵ Bachelard (1970), p. 80 : 'The scientific boundary is not so much a limit as a zone of particularly active thought, a domain of assimilation.' (My translation); Canguilhem (2003), p. 120.

¹⁴⁶ Deleuze (1999), p. 30.

Although all of these figures may be productive to analyse the relation that Kant establishes, I argue that it signifies Kant's negotiation of his *a priori*. As discussed above, Kant regards the *a priori* as that which is divorced from experience and represents the condition of possibility of understanding.

Foucault refers in his own work to the idea of an 'historical *a priori*'.¹⁴⁷ He uses the notion of '*épistémè*' in order to inquire into the historical conditions of possibility for the emergence of various ways of knowing (rather than - as Kant did - to inquire into the condition of possibility for knowledge as such). The historical *a priori* does not represent the historical origin of knowledge. Although the very notion may seem paradoxical, Foucault regards the *épistémè* - through which he inquires into this *a priori* - as an historical practice; it represents the discursive regularities of a particular period in time.¹⁴⁸ He proposes the idea of an historical *a priori* as a method for his own inquiries rather than using it to question the nature of Kant's *a priori*.

I argue that - even if Kant represented the *a priori* as necessary, universal, and distinct from experience - he himself negotiated the historicity and vitality of his *a priori* through his elaboration of the relation between knowledge and life. The exclusion of living processes from his theory of understanding in order to establish the *a priori* leads to his subsequent renegotiation of this exclusion in the third *Critique*. The only way in which the *a priori* can survive is by limiting its application to processes or objects that are susceptible to reason and understanding. The third *Critique* provides a means of judgment or intelligibility of living processes that the *a priori* cannot offer because of its a-historical and 'a-vital' nature.

What are the implications of Kant's negotiation of the *a priori*? One of its consequences, I argue, is a recurrence of the negotiation of the relation between knowledge and life in the life and social sciences. Although efforts are made to articulate this relation anew, the representation of living processes - or 'life' - as that which grounds knowledge and at the same time escapes it has characterized philosophy and the sciences since the nineteenth century. When the relation between knowledge and life that Kant elaborated is regarded as indicative of his own (re)negotiation of the *a priori*, then it becomes possible to question this *a priori* that lies at the basis of modern rationality. The historicity and vitality that it

¹⁴⁷ Foucault (2006), p. xxiii; Agamben (2008), p. 107: Agamben believes that it was Mauss, rather than Kant, who inspired Foucault's idea of the historical *a priori* (which seems very unlikely); Deleuze (1999), p. 51.

¹⁴⁸ Agamben (2008), p. 108.

excludes can form part of a new articulation of the relation between knowledge and life; one that is, I argue, undertaken by Canguilhem (see Chapter 5, para. 3.2).

PART III

3.1 Opening up the question for questioning

3.1.1 *The articulation of a relation*

In the introduction to an issue of the *Revue de Métaphysique et de Morale* dedicated to Canguilhem, Foucault observed that in France the question of the meaning of the Enlightenment is debated in the history of science.¹⁴⁹ It is scientific knowledge that is regarded as ‘the origin and threshold of rationality’.¹⁵⁰ According to Foucault, the same question is debated in Germany in a different arena: through historical and political reflection on society. Nevertheless, both debates share a common object: the autonomy of reason and its history of ‘dogmatisms and despotisms’.¹⁵¹

The latter is a reference to Kant’s attempt to distinguish himself from his predecessors. Kant noted, with regard to metaphysics, that ‘[a]t first, her government, under the administration of the *dogmatists*, was an absolute *despotism*’.¹⁵² Foucault turns Kant’s words against him by accusing him, despite his efforts to rehabilitate metaphysics, of the very sin of which Kant himself had previously accused his predecessors. He suggests that Kant’s reason can only be rid from its despotic character and that reason ‘has the effect of emancipation only on the condition that it succeeds in freeing itself of itself’.¹⁵³

In a different essay, Foucault identifies Kant’s work as the source of the idea of reason as autonomous.¹⁵⁴ Kant’s project sought to liberate man from his self-incurred tutelage and this led him to describe how reason could be exercised independently. Foucault also focuses on the importance of Kant’s reflection on ‘the contemporary status of his own

¹⁴⁹ Foucault (1985), p.6. This essay appeared earlier, in a slightly different version, as introduction to the English translation of *Le normal et le pathologique* (Foucault (1978)).

¹⁵⁰ Foucault (1978), p. xi.

¹⁵¹ Ibid., p. xii.

¹⁵² Kant (2003), p. viii; Kant (1987): Translator’s Introduction, pp. xxxi-xxxii, on Kant’s relation to these dogmatists.

¹⁵³ Foucault (1978), p. xii.

¹⁵⁴ Foucault (1984), p. 36.

enterprise' and on the way in which Kant's work, perhaps paradoxically, gives rise to a focus on the historically contingent rather than on universal truths and limits of knowledge.¹⁵⁵ However, it is more significant for our purposes that Foucault observes how it was Kant (and Hegel) who formulated for the first time the question of the relation between truth and life rather than truth and subject.¹⁵⁶

This statement of Foucault seems to go against the commonly held view that Kant established the subject for the first time as an autonomous entity and placed it at the centre of his theory of cognition. However, he seems to say that - even if Kant focused on the subject as the centre of knowledge and understanding - there was something else, a relation between reason and life, that ran through his work and perhaps complicated his philosophy. Foucault believes that this 'undercurrent' of Kant's philosophy opens up the question of whether the knowledge of life should be regarded as another instance of knowledge that functions within the triangle of truth, subject, and knowledge, or whether the knowledge of life leads to a reformulation of the question of knowledge itself.¹⁵⁷

Foucault, therefore, identifies Kant's work as that which establishes the autonomy of reason and at the same time suggests how it might be questioned. I argue that Foucault at the end of his life - the essay in the *Revue* was the last publication before his death -¹⁵⁸ identified not only a tension in Kant's work but also in his own. It is commonly held that Foucault elaborates his work within the triangle of truth, subject, and knowledge. However, at the same time there is a preoccupation with life that traverses this triangle and continuously stretches it. For example, Foucault's idea of 'biopower' does not ground his notion of subjectivity, as some commentators would suggest. Rather, it questions it fundamentally; it threatens to either break with the traditional triangle or reformulate it (something that - in the end - is never fully accomplished).

It has been noted that Foucault's work can be regarded as a 'self-critical continuation of the Enlightenment project' in the sense that he 'appropriates' Kant's focus on reason in his striving for freedom and autonomy.¹⁵⁹ Deleuze pointed out some neo-Kantian aspects of

¹⁵⁵ Ibid., p. 38.

¹⁵⁶ Foucault (1978), p. xx: He refers to the *Critique of Judgment* and the *Phenomenology of Spirit*.

¹⁵⁷ Ibid.

¹⁵⁸ Agamben (1999), p. 220: it was the last essay for which Foucault gave his consent to publish.

¹⁵⁹ Gutting (1989), pp. 262 and 1-2; Norris (1994), p. 169 and 184.

Foucault's thought.¹⁶⁰ Foucault agrees with Kant that critique must take the form of questioning limits; the difference is that Foucault's work is concerned with the ways in which reason itself can become constraining, limiting, and despotic rather than liberating.¹⁶¹

3.1.2 *The modern representation of 'life'*

I argued that the autonomy of reason that Kant's system establishes, and that comes to define modern rationality, is made possible through a simultaneous reliance on - and exclusion of - living processes from knowledge. The reliance on living processes is represented by Kant's well-known epigenesis metaphor in the second edition of his first *Critique*, while the exclusion of living processes from knowledge is elaborated in his third *Critique*. The latter is effected through the regulative principle of purposiveness, also described by Kant as the 'lawfulness of the contingent'. It is this two-pronged approach that comes to represent the traditional figure of 'life', discussed by philosophers from the nineteenth century onwards, as that which makes knowledge possible and at the same time eludes it.

Foucault describes in his book *Les mots et les choses* how the emergence of modern rationality corresponds with the moment when life comes to lie at the heart of knowledge.¹⁶² More specifically, he describes how a notion of 'life' emerges at the end of the eighteenth century that did not exist before.¹⁶³ This notion of 'life' represents, according to him, the condition - and the limit - of knowledge: it concerns a 'limiting and conditional position (that without which and beyond which one cannot know)'.¹⁶⁴ Before this emergence of the notion of 'life', living entities formed the subject matter of natural history but there was no inquiry into the common trait that united such entities. Natural history was concerned with the classification of living organisms; it sought to draw up an inventory of the world that could be unlocked and explored through the conceptual tools of identity and difference.

¹⁶⁰ Deleuze (1999), pp. 51 and 104-105. Foucault inquires, like Kant, into the conditions of possibility of knowledge. However, Foucault regards these conditions as historical and particular rather than universal. Also, Foucault takes the 'finitude' of man - often associated with Kant - as object of inquiry.

¹⁶¹ Gutting (1989), pp. 262.

¹⁶² Foucault (2004), p. 264.

¹⁶³ Ibid., p. 173.

¹⁶⁴ Foucault (2006), p. 77 (with regard to resemblance rather than life, but the figure is the same).

Without explaining in much detail why this might be the case, Foucault argues that - at this particular point in time - the need arose to inquire into what links different natural entities rather than what separates them. This link or identifiable 'trait' of life was found in the idea that natural entities have an internal order or organization that defines them as such, as opposed to the external ordering represented by classification.¹⁶⁵ It is this particular notion of 'life' that subsequently comes to traverse the classificatory categories of knowing. According to Foucault, since the emergence of the concept of 'life' at the end of the eighteenth century it has taken on the specific form of condition and limit of knowledge; as that which gives rise to knowledge but itself remains inscrutable. It is this connection between the limits and the possibility of knowing that, according to Foucault, characterizes modern rationality.¹⁶⁶

The resonance of Kant's philosophy is obvious in Foucault's description of the emergence of the concept of 'life' and its association with modern rationality. Both in terms of the substance of the idea of self-organization as an identifying trait of living processes and in terms of the attribution of this particular shift in episteme to the end of the eighteenth century. However, Foucault does not refer to Kant in much detail. He observes that Kant's *Critique* marks the foundation of modernity because of its questioning of the mode of thought that defined the sixteenth and seventeenth century: representation.¹⁶⁷ Foucault also notes that the Kantian *Critique*, by rehabilitating metaphysics

opens up at the same time the possibility of another metaphysics ; one whose purpose will be to question, apart from representation, all that is the source and origin of representation ; it makes possible those philosophies of Life, of the Will, and of the Word, that the nineteenth century is to deploy in the wake of criticism.¹⁶⁸

Kant's *Critique*, therefore, opens up the possibility for philosophies of 'Life' (i.e., life as a transcendent form) such as - arguably - those of Bergson and Canguilhem (see Chapter 6).

¹⁶⁵ Foucault (2004), p. 250. Rheinberger (1997a), p. 20, notes how Foucault (and Jacob) focus a little too much on organization as the identifying trait of the 'living' and as the defining concept of the emerging discipline of biology without taking into account the 'interindividual and intraspecific dimensions that most ... concepts gained around 1800. Instead of referring, as in earlier times, to individual bodies, organic functions like generation, growth, development, nutrition, and sensation were increasingly perceived as reproductive functions physically constituting the unity of species'.

¹⁶⁶ Mathiot (1993), p. 194: notes that the problem of the living knowing itself as living is not particularly modern but goes back to Aristotle. Aristotle regarded it as a privileged position of knowledge, rather than as an obstacle to knowledge. The difference is that in Aristotle's day 'life' was not regarded as a concept in itself.

¹⁶⁷ Foucault (2004), p. 255.

¹⁶⁸ Foucault (2006), p. 264.

I argue that the representation of 'life' as condition and limit of possibility can be traced back to Kant's inclusion and exclusion of living processes from reason. Kant introduced the idea that living processes represent the boundary between the knowable and the unknowable; this is what unifies the manifold living processes. It is this that these processes have 'in common' and what therefore, from Kant's explanation onwards, defines them as 'living'. Most philosophers since Kant have represented life or living processes both as engendering knowledge and as limiting, escaping, or overflowing it.¹⁶⁹ According to Foucault, it is the impossibility of knowing life through reason or through lived experience that motivates the search for '*la connaissance de la vie*' and the discipline of biology as such.¹⁷⁰

Agamben also points out the particularity of the modern notion of 'life'. He contrasts it with how Aristotle explored life without ever proposing a definition of it and without ever representing life as a concept as such. Rather, Aristotle 'decomposed' life (which, of course, is in itself a modern reading of Aristotle) into its various functions.¹⁷¹ According to Agamben, it was Aristotle's representation of life as a variety of functions that could be distinguished and combined that made the subsequent emergence of a unitary conception of life possible.¹⁷² What characterizes the modern concept of 'life' is its indeterminacy and lack of definition that - arguably - provides it with its multidisciplinary relevance and strategic potential.¹⁷³

The modern notion of 'life' was still prevalent at the beginning of the twentieth century, but perhaps less prominent. In order for the discipline of biology to develop it was necessary to focus on specific questions regarding living processes rather than on biology's self-justification as a discipline through reference to a unified notion of 'life'.¹⁷⁴ However, the notion of 'life' was revived after the Second World War this time with a more specific aim: to assess the character and contribution of 'new' disciplines such as biochemistry and molecular biology and attribute a place to them in relation to biology. However, apart from the political or strategic role that the notion of 'life' fulfilled during that time, it seemed - in

¹⁶⁹ Dagognet (1997), p. 175: a 'vitality that overflows intelligence (like Nietzschean normativity with its fringe of insubordination)'.

¹⁷⁰ Ibid., p. 120.

¹⁷¹ Agamben (2002), pp. 26-27.

¹⁷² Ibid., p. 28.

¹⁷³ Ibid., p. 26.

¹⁷⁴ Lenoir (1982), p. 1.

its traditional form - no longer very productive for addressing the various aspects of living processes. Research no longer, or perhaps had never, required a unified notion of life.¹⁷⁵

Nevertheless, discussions on the possibility and ways of knowing living processes in the contemporary life and social sciences still seem to rely on the modern concept of 'life' and on the particular relation between knowledge and life that it depends on. Such discussions often focus on the irreducibility of biological processes and on the inability of analytical thought to adequately capture such processes. The empirical diversity and contingency of living processes that Kant referred to in order to explain why such processes are 'beyond reason' are often referred to in recent discussions in terms of 'contingency', 'emergence', and 'complexity'. As Bergson observed:

[I]n fact, we do indeed feel that not one of the categories of our thought - unity, multiplicity, mechanical causality, intelligent finality, etc. - applies exactly to the things of life: who can say where individuality begins and ends, whether the living being is one or many, whether it is the cells which associate themselves into the organism or the organism which dissociates itself into cells? In vain we force the living into this or that one of our molds ('*cadres*'). All the molds crack. They are too narrow, above all too rigid, for what we try to put into them.¹⁷⁶

Kant himself said that living processes cannot be captured through the categories but require their own regulative principle of judgment. Although the modern concept of 'life' seems to be productive because it creates a domain of knowledge specifically for living processes, knowledge is at the same time put beyond reach of such processes. The notion of 'life' itself represents a particular relation, or rather an ongoing articulation and negotiation of a relation, between knowledge and life. How does Canguilhem confront this Kantian problematic that has come to define the modern life sciences?

¹⁷⁵ Cf. Goldstein (1995), p. 26.

¹⁷⁶ Bergson (1975), p. xx.

PART IV

4.1 Canguilhem's lateral engagement

4.1.1 *The French critique of Critique*

Canguilhem is not the first or the only French philosopher to engage critically with the ideas that Kant elaborated in his three *Critiques*.¹⁷⁷ The form that various criticisms take is very much determined by the particular interests of the respective philosophers. Bergson, for example, focuses mostly on Kant's notions of space and time in relation to living processes with which he contrasts his own idea of '*durée*', characterizing living processes as inherently temporal.¹⁷⁸

Bachelard addresses two different aspects of Kant's theory. First, he argues - more generally - that any philosophy is necessarily only adequate in a particular historical and scientific context. This argument limits the relevance of Kant's own system to the time in which he wrote, thereby undermining the universal validity that Kant aspired to.¹⁷⁹ Second, Bachelard points out how the mind's constitution of objects is mediated through instruments rather than through categories. These instruments can themselves transform a theory of knowledge or understanding when they are regarded as 'theories materialized'.¹⁸⁰

Foucault, similarly to Bachelard, focuses on how conditions of knowledge are not universal *a priori*, but contingent and historical. He, furthermore, focuses on 'transgression' rather than on the 'limitation' that characterizes Kant's work.¹⁸¹ More importantly, Foucault emphasizes that modern rationality promotes the autonomy and universality of reason while it depends on contingent processes in order to establish that reason.¹⁸² He also argues that concepts do not necessarily introduce a distance between knowledge and life. Rather, concepts should be regarded as representing a certain way of living through knowing.¹⁸³ This idea of the concept as a form or technique of living can be traced back to Canguilhem.

¹⁷⁷ See Gutting (2005b), pp. 3-6, for Kant's influence on French philosophers generally.

¹⁷⁸ Bergson (1908), pp. 222-237. For Kant's understanding of space, see Chapter 3 (para. 2.2.3).

¹⁷⁹ See Lecourt (1974), p. 49.

¹⁸⁰ Lecourt (1975), pp. 137-138; *ibid.*, p. 120; see also Rheinberger (2005a) on the notion of 'phenomenotechnique' and the epistemic function of technology in Bachelard's philosophy.

¹⁸¹ Foucault (1984), p. 45. Kant's work does not focus on limitation as such, but on the functioning of reason.

¹⁸² Foucault (1978), p. xii.

¹⁸³ *Ibid.*, p. xviii.

Foucault hinted at the idea that the significance of Canguilhem's work lies in the way in which it engages with modern rationality. More specifically, Canguilhem seems to expose and follow through on the 'undercurrent' of the relation between knowledge and life that runs through Kant's work through his idea of a '*connaissance de la vie*' (see Chapter 5, para. 3.2.1). I argue that Canguilhem's work can be read as an effort to, in Foucault's words, let reason 'free itself from itself'. Canguilhem does not dismantle or deconstruct the rationality proposed by Kant. This would only be possible through an employment of reason and would, therefore, not challenge reason itself. Canguilhem's approach is much more unconventional and inconspicuous.

4.1.2 *The 'possibility of possibility'*

In Chapter 1, I pointed out how Nietzsche receives very little mention in Canguilhem's work even though he - arguably - represents one of the greatest influences on Canguilhem's thought. He only refers to Nietzsche a few times and, when he does, seems to attribute a way of thinking to him that runs contrary to his own. Similarly, although Kant's thought clearly represents Canguilhem's biggest challenge, he mostly refers to Kant with regard to the latter's idea of the self-generation of organisms. Such 'lateral' engagement with the philosophers that influenced his work seems slightly confusing. However, it can be argued that Canguilhem's focus on self-generation in Kant's work performs a particular function.

Rather than focusing on the subject of Kant's theory of understanding - i.e. not the subject of knowledge but the autonomy of reason - and seeking to challenge that autonomy, Canguilhem focuses on that which makes such autonomy possible. As Heidegger would say, Canguilhem does not focus on the possibility of the autonomy of reason but on the possibility of that which makes that autonomy possible.¹⁸⁴ Canguilhem does not discuss the epigenesis analogy specifically but by addressing the idea of self-generation reveals the way in which Kant's rationality already contains within itself the conditions for its own dismantling.

Whereas Kant excludes life from knowledge in order to establish the autonomy of reason, Canguilhem includes life in knowledge - or rather knowledge in life - by representing

¹⁸⁴ Heidegger (1997), p. 7: Heidegger says that one should not focus on the possibility of knowledge, but on the possibility of that which makes knowledge possible.

knowledge as one, and the most privileged, of life's forms.¹⁸⁵ Although Canguilhem argued that knowledge is a form of life, this does not make him an empiricist in the sense that he derives knowledge from life or from experience.¹⁸⁶ Canguilhem does not reason from a distinction between experience and understanding, or life and knowledge, at all. Indeed, he does not reason from reason. Rather, he argues that the living can only be known through living and not through reason or judgment.¹⁸⁷ This points towards the political motivation behind Canguilhem's work.

4.1.3 *Canguilhem's vital politics*

The political motivation for Kant's project was, as described above, the liberation of man from his self-incurred tutelage through the autonomy of reason. The justification for this idea was very much linked to the political situation of the time. It is unlikely that Canguilhem, writing almost two centuries later, would have had the same political motivation as Kant. Rather, Canguilhem - like Bachelard before him - sought to challenge the rationality that Kant proposed; something that had been topical in French philosophy, and French philosophy of science, for at least a few decades.¹⁸⁸ Bachelard, who sought to question reason through physics rather than the life sciences, said that no matter how much we try to become rationalists, '*la vie se met en travers*'.¹⁸⁹ Bachelard did not elaborate on this statement, although he probably realized that it could be taken quite literally.

Bergson pointed to the necessity of inquiring into life when questioning knowledge or reason:

[T]his amounts to saying that *theory of knowledge* and *theory of life* seem to us inseparable. A theory of life that is not accompanied by a criticism of knowledge is obliged to accept, as they stand, the concepts which the understanding puts at its disposal: it can but enclose the facts, willing or not, in pre-existing frames which it regards as ultimate ... On the other hand, a theory of knowledge which does not replace the intellect in the general evolution of life will teach us neither how the frames of knowledge have been constructed nor how we can enlarge or go beyond them. It is necessary that

¹⁸⁵ See Bowker & Latour (1987), pp. 740-741, on the French emphasis on epistemology in relation to the sciences.

¹⁸⁶ Lecourt (1975), p. 185, suggests that Canguilhem's identification of life and concept puts him 'in the camp of *empiricist* theories of knowledge'.

¹⁸⁷ Goldstein (1995), p. 22: Canguilhem was probably inspired by Goldstein's realization that "'biological knowledge is a form of biological being." Biological knowledge is possible because of the similarity between human nature and human knowledge'.

¹⁸⁸ Judt (1992), p. 76: 'A skeptical rejection of both conventional rationalism and the optimistic neo-Kantian heritage of the academic French tradition had already marked a generation of young thinkers.'

¹⁸⁹ See Dagognet (1985), p. 38.

these two inquiries, theory of knowledge and theory of life, should join each other, and, by a circular process, push each other on unceasingly.¹⁹⁰

Kant complied with Bergson's statement by referring to life in order to explain the constitution of his categories and their correspondence to the world. However, he subsequently sought to limit the role that life plays in his theory by formulating the epigenesis analogy and by representing this analogy as a mere illustration that is otherwise inconsequential. In this way, Kant undoubtedly sought to avoid the risk that Bergson was referring to, namely that his carefully construed moulds ('*cadres*') of thought - or categories of understanding - would be stretched or surpassed.

In contrast to Bachelard, Canguilhem addresses reason or rationality through the life sciences and therefore confronts the problematic core that lies at the heart of modern rationality directly. He focuses on reason not in order to condemn it but in order to 'mobilize' or 'derigidify' it.¹⁹¹ Canguilhem himself is in many ways a rationalist, even if he does not agree with the distinction between life and knowledge upon which Kant's particular rationality is based.¹⁹² When Foucault said that the rationality that threatens life is the same rationality as that of life itself, Canguilhem responded: 'But let's say there is rationality and rationality'.¹⁹³

Canguilhem only wishes to call himself a rationalist 'if one understands by reason not so much the power to perceive essential aspects of the reality of things or of thought, as the power to determine normative aspects of life experience'.¹⁹⁴ In other words, reason is not so much - as it is traditionally regarded - about perceiving order in the world as it is about the power to institute norms regarding lived experience. Reason is not primarily about knowledge, understanding, or cognition. Rather, it is a normative project that functions through the imposition of norms on life and living processes. It is this imposition of norms that makes knowledge possible; knowledge is, therefore, only a consequence of a project of rationalization and normalization (see Chapter 6, para. 3.2.2).

¹⁹⁰ Bergson (1975), p. xxiii-xxiv.

¹⁹¹ Dagognet (1985), p. 37.

¹⁹² Ibid.: Dagognet speaks of '*un vitalisme rationnel*' or '*un rationalisme appliqué vivant*'. Cf. Canguilhem (1994a): this probably inspired the title of this book; Bowker & Latour (1987): pp. 725 and 740-741.

¹⁹³ Canguilhem (2002), p. 340 (my translation).

¹⁹⁴ Canguilhem (1947), p. 332, referring to Bachelard's statement: 'Rationalist? We are trying to *become* it ...' (My translation).

Although in Kant's system living processes cannot be known, they can be judged according to their conformity to a norm or concept. It is this necessary subjection of the living to normative standards that Canguilhem finds objectionable. The political motivation of Canguilhem's project is not the liberation of man from his self-incurred tutelage, as it was for Kant. It is the liberation of reason from itself, as Foucault said.¹⁹⁵ The consequence of this liberation of reason is the liberation of *vivants* from normative judgment and anthropological scrutiny. Canguilhem challenges the relation between life and knowledge that Kant proposes, because it makes it impossible for an organism to be regarded on its own terms. For Kant, the organism is compared to what it 'ought to be' thereby enabling a subject to judge it.¹⁹⁶ This institutes the idea of the 'normal' in relation to the living, a term that has become central in medicine and that Canguilhem questions in his thesis in medicine.¹⁹⁷

However, Canguilhem does not merely 'liberate' *vivants* from normative judgment. Rather, I argue that he radically transforms the understanding of the 'normative'. His notion of 'vital normativity' does not concern normativity from the perspective of a subject exercising normative judgment (see Chapter 6). I argue that Canguilhem's idea of 'vital normativity' corresponds with a contemporary focus on contingency and emergence. It no longer seems necessary to unify the manifold living processes in order to make them intelligible. Rather, the manifold represents its own normativity and in order for it to be known, it is this normativity or contingency that must be understood. This raises the question of whether this normativity can still be understood by reference to a traditional understanding of knowledge (see Chapters 5 and 6).

CONCLUSION

It has been argued that the recent engagement of the social sciences with the life sciences revolves around the suggestion that modern rationality is defined by the way in which life has come to lie at the basis of knowledge. I have argued that the particular representation of life as that which grounds knowledge and at the same time eludes it can be traced back to the work of Kant. His idea of the autonomy of reason was established by reference to the idea of an 'epigenesis of pure reason' and a subsequent exclusion of life from reason

¹⁹⁵ Foucault (1985), p. xii.

¹⁹⁶ Ginsborg (1997), p. 340; Ginsborg (2001), p. 251.

¹⁹⁷ Canguilhem (2006).

through the idea of the 'lawlikeness of the contingent'. I have explained the reason for the recurring negotiation of the relation between knowledge and life that Kant established with reference to Kant's own negotiation of the historicity and vitality of his *a priori*.

I have subsequently argued that, as Foucault suggested, the significance of Canguilhem's work must be sought in how it engages with modern rationality. Canguilhem's work can be read as an effort to let reason 'free itself from itself' by introducing the idea of knowledge as a form or technique of life and the idea of a 'vital normativity' - to be addressed in Chapters 5 and 6, respectively. Canguilhem's engagement with some of the most basic forms of modern rationality is further explored in the following chapters. The first concept to be addressed is that of 'environment'.

3. THE ENVIRONMENT

PART I

1.1 Introduction

1.1.1 *The problematic notion of 'environment'*

In a footnote in his book *Social Systems*, Niklas Luhmann observes:

[T]he length of time required to learn [the concept of environment] testifies to the difficulty of the idea. Ever since the sixteenth century, word compounds containing 'self' and '*Selbst*' have proliferated in Europe. Yet a good two hundred years were needed before anyone noticed that this presupposes an environment.¹

The footnote refers to Canguilhem's work on the notion of 'milieu'.² The question that - at least indirectly - informs both the inquiries of Luhmann and Canguilhem is: why does Western rationality find the concept of the environment so problematic? Different disciplines, including - perhaps most instructively - the life sciences, have sought to come to grips with this notion through continuous efforts to rethink the concept of environment.

Recently, there has been a critical inquiry into the relation between individual and environment in the life sciences. Such inquiry is guided by the question, as formulated by Bateson, 'what sort of thing is this, which we call "organism plus environment"?'.³ In 'developmental systems theory',⁴ for example, the traditional relation between individual and environment is reconsidered through notions such as that of 'system' and 'constructivist interaction'.⁵ The objective is to 'replace conventional wisdom's "interaction" between separate and independently defined organisms and environments' with the idea that 'organisms and their environments define the relevant aspects of, and can affect, each other. This is called the "interpenetration" of organism and

¹ Luhmann (1996), pp. 537-538 (Ch. 5, n. 2). Luhmann often addresses important issues in footnotes, see e.g. Winthrop-Young (2003), pp. 311 and 333.

² Canguilhem (2003), pp. 165-197 ('*Le vivant et son milieu*').

³ Bateson (2000), p. 455.

⁴ Oyama (2000), p. 2.

⁵ Ibid., p. 6 and 3.

environment.’⁶ Furthermore, a shift in focus is proposed from “‘genes and environment” to a multiplicity of entities, influences, and environments’.⁷ The notion of the environment as a singularly defined entity, or as one term in the individual/environment relation, is at the same time contested and repeated. The rejection of the traditional notion of environment seems to make any inquiry into the concept irrelevant.

I argue that Canguilhem’s discussion of the ‘milieu’ reveals how the concept of ‘environment’ cannot be rethought if the problem that this concept preserves is left unaddressed. If one wishes to challenge the traditional relation between environment and individual, then the notion of environment should not be rejected or transcended. Rather, Canguilhem turns ‘environment’ into a concept - or a ‘category of contemporary thought’⁸ (see para. 1.1.2 below) - in order to probe its problematic character.

Canguilhem observes that a biological theory of environment has yet to be formulated.⁹ The notion of environment was originally elaborated in physics. Most disciplines, including the social sciences, continue to rely on the idea of environment as a ‘physical fact’. Canguilhem observed : ‘the environment is considered as a physical fact, not as a biological fact, as an already constituted fact and not as a fact to be constituted’.¹⁰ The assumption of the environment as fact stands in the way of the elaboration of a genuine biological concept of environment.

Paradoxically, however, Canguilhem seems to suggest that in order to develop a biological concept of environment the physical notion of environment should not be dismissed. Rather, we should return to its origins. He shows how the idea of ‘milieu’ introduced into physics by Newton did not resemble the ‘physical fact’ that the environment has since come to represent. In fact, Canguilhem argues that it was only the introduction of the notion of ‘milieu’ into the life sciences that lead to its transformation into a ‘physical fact’. He describes the surprising subtlety of Newton’s original notion of ‘milieu’, implicitly suggesting that its inherent ambiguity and

⁶ Ibid., p. 3, referring to Lewontin.

⁷ Ibid., p. 3.

⁸ Canguilhem (2003), p. 165.

⁹ Ibid., p. 123: ‘But a general theory of the milieu, from an authentically biological point of view, remains to be elaborated ... as von Uexkull has sought to do for the animal and Goldstein for the ill.’ (My translation)

¹⁰ Canguilhem (1978), p. 177.

association with action might be productive for the elaboration of a biological concept of environment.

1.1.2 A 'category of contemporary thought'

Canguilhem wrote as an introduction to his essay '*Le vivant et son milieu*':¹¹

[T]he notion of milieu is in the process of becoming a universal and obligatory mode of grasping the experience and existence of living beings and one could almost speak of its constitution as a category of contemporary thought.¹²

In this essay, he traces the formation of the concept of environment and assesses its significance for 'a philosophy of nature centred on the problem of individuality'.¹³ The environment is often represented as differentiated from - and as the precondition for the emergence of - the individual. In spite of that function, or perhaps because of it, the question of environment has never been as central as the question of the individual. Canguilhem shows how the life sciences tirelessly shift emphasis from one term of the individual/environment relation to the other.¹⁴ The significance of 'environment' as a concept in itself and the consequences of its use, however, remain largely unexplored.

What might Canguilhem's statement, cited above, mean? What potential is attributed to the concept of 'milieu' as 'category of contemporary thought'? It may not be entirely coincidental that the term 'category of thought' seemingly refers to the Kantian notion of the category as a principle of understanding (Chapter 2). However, whereas the Kantian category represents a condition of possibility of understanding, the characterization of 'milieu' as a category of contemporary thought locates the emergence of that concept in a particular time and a particular rationality.¹⁵

The 'milieu' can also be regarded as a medium through which different rationalities are negotiated. For example, Kant's focus on the subject as the centre of his theory of understanding necessitates a particular interpretation of environment as 'space' (see para. 2.2.3 below). The recognition of the significance of environment by Canguilhem

¹¹ Canguilhem (2003), pp. 165-197.

¹² Ibid., p. 165 (my translation).

¹³ Ibid.

¹⁴ Ibid., pp. 182-184.

¹⁵ See, e.g., Foucault (2004), p. 13. It might be that this idea inspired Foucault's notion of 'épistémè'.

and, subsequently, Luhmann opens up a different rationality in which any privileged centre of reference becomes either impossible or provisional (see para. 4.1 below).

1.1.3 The ambiguity of ‘milieu’

Canguilhem’s identification of the concept of ‘milieu’ as an important theoretical notion is of renewed relevance at a time when the relation between individual and environment is being thoroughly reconsidered. In what follows, ‘milieu’ is to be understood as a ‘category’ or a kind of meta-concept that manifests itself in various ways and migrates across disciplines.¹⁶ I argue that its intrinsic ambiguity contributes to its potential as a theoretical notion.

This ambiguity is, first of all, linguistic. The French word ‘*milieu*’ is indeterminate and ambiguous: it can mean middle or centre, medium, and surroundings.¹⁷ The English translation of ‘environment’, as well as the German ‘*Umgebung*’, is less ambiguous and usually refers to external surroundings. In the following paragraphs, the words ‘environment’ and ‘milieu’ are used interchangeably; the use of either term will be emphasized when it has particular theoretical significance.

The ambiguity of the ‘milieu’ is also conceptual. The environment can be regarded as external surroundings with reference to a centre and as a relative medium that calls such centres of reference into question. The notion of ‘milieu’, furthermore, calls into question the traditional distinction between inside (organism) and outside (environment) (see para. 2.2.1 below).

1.1.4 Consequences of conceptualizing ‘environment’

Lack of attention for the environment as a concept might indicate its relative lack of significance or it might be attributed to the difficulty of engaging with its inherent

¹⁶ Canguilhem (2003), p. 165, referring to the various usages of ‘milieu’ in geography, biology, psychology, technology, and economic and social history.

¹⁷ Deleuze & Guattari (1999), p. xvii, also make use of this ambiguity.

elusiveness.¹⁸ The intention here is not to argue that the environment is just as important, or more important, than the individual.¹⁹ Rather, I argue that the notion itself is representative of a particular rationality and that the different ways in which it is deployed has significant consequences for a theory.

There is little point in asking what the environment 'is'. First, the concept of the environment tends to dissolve, or at least destabilize, ontological entities and centres of reference. Second, the notion represents many different things in many different instances. So the better question is what the environment *does* as a figure of thought and what the specific consequences are of its use. Three potential difficulties arise in addressing this question.

The first is that the question itself suggests the existence of a coherent theoretical notion that lends itself to discussion.²⁰ Any discussion of a concept runs the risk of identifying certain usages and manifestations at the expense of others. Canguilhem addressed the use of the notion of environment in different periods and contexts, but he also believed that its productivity or its potential could transcend these different usages.

The second difficulty is that 'environment' is usually represented as one term of the individual/environment relation. The focus of inquiry tends to shift towards the individual while the environment is merely regarded in relation to, and as constitutive of, this individual. To avoid this drift to the individual is not to see the environment as something separate from - and opposed to - the individual; it is only to explore the potential of the concept in its own terms.

The third difficulty is that foregrounding the environment risks turning it into an absolute notion thereby causing it to lose one of its most important characteristics: its relativity or ambiguity.²¹ However, as Canguilhem recognized, it is only by means of

¹⁸ Schütz (1997), p. 275: '[T]he very notion of an environment of the social system is in constant danger of retreating back into invisibility and of lapsing back into in its habitual dwelling place of unsolved (unproblematized) complexity: the onto-epistemological trap, or the limbo of knowledge that swallows and holds captured those phenomena which are too general and too present to be perceived'.

¹⁹ See Oyama (2000), p. 18, refers to arguments taking the form of 'the environment is important, too'.

²⁰ Hage (1978), p. 103: attempts have been made 'to find some general variable such as stability or turbulence or complexity. Most of these studies have emphasized a single variable which is then used to characterize the entire environment'.

²¹ Canguilhem (2003), p. 167.

such a foregrounding that one can reveal the potential of 'milieu' as a 'category of contemporary thought'.

1.2 Traditional representations of 'milieu'

1.2.1 *The environment as resource or 'conditions of life'*

One of the most common understandings of environment is that it constitutes a resource; something that enables or sustains the development of an organism and its characteristics. This understanding of environment represents it as a more or less accessible 'outside' to an organism. However, inquiry into the historical formulation of the interrelation between organism and environment in relation to heredity shows how

[t]he organic processes of transmission, development, nutrition, and adaptation were not distinguished in early modern theories of generation, nor were, in consequence, inherited, connate and acquired properties of organisms. Nature and nurture, or heredity and environment, were not yet seen as oppositions.²²

Apart from the distinction between organism and environment, the role of environment in relation to the organism has been subject to significant change. Foucault described, with reference to Cuvier, how differences between species were initially explained by reference to variations in classification rather than by reference to the influence of external factors on living beings. Differentiation was only later linked to the external environment:

[E]xternal factors are no longer, as for natural history, mere occasions for the appearance of species whose natures and interrelations are already determined by their place in the system of representation. For modern biology, the nature of a species is causally dependent on the environment in which its members exist.²³

How did these shifts in thinking the relation of environment to organism come about? First, how did environment come to be regarded as distinct from organism? And second, how did environment come to be regarded as a resource sustaining life, as a potential danger or threat, and - only subsequently - as a necessary component in the creation and transformation of different life forms?

²² Müller-Wille and Rheinberger (2007), pp. 3-4.

²³ Gutting (1989), p. 191.

It could be argued that contemporary biology still relies on, and struggles to overcome, the relation between organism and environment that Darwin elaborated.²⁴ Darwin was, arguably, the first to formulate a distinct difference between internal and external processes.²⁵ Contrary to Lamarck, he represented the variation of organisms as a process that did not primarily rely on an environment. The organism and environment were represented as having two separate histories; their only interaction was through the process of selection.²⁶

Darwin discussed environment by reference to, what he called, 'physical conditions of life'.²⁷ However, he did not explore these conditions in detail; the most prominent examples he gave were that of climate and food. Rather, his focus was on the 'co-adaptations' of organic beings to each other and to these external conditions.²⁸

How have all those exquisite adaptations of one part of the organisation to another part, and to the conditions of life, and of one distinct organic being to another being, been perfected? We see these beautiful co-adaptations most plainly in the woodpecker and mistletoe; and only a little less plainly in the humblest parasite which clings to the hairs of a quadruped or feathers of a bird; in the structure of the beetle which dives through the water; in the plumed seed which is wafted by the gentlest breeze; in short, we see beautiful adaptations everywhere and in every part of the organic world.²⁹

Apart from these adaptations, Darwin argued that it is 'preposterous' to attribute variation solely to the various conditions of life.³⁰ Since he believed that the 'direct effects' of external conditions on variation were negligible,³¹ he focused mainly on the relation between organic beings and their effects upon each other. In other words, the environment of an organism is mostly represented by other organic beings rather than by the physical conditions of life.³² Despite Darwin's focus on organisms, it has been argued that the organism in fact merely represents a 'passive medium' or a 'passive nexus of independent external and internal forces' in his work, that allowed him to explain the processes of adaptation and evolution.³³

²⁴ Lewontin (2000), p. 43.

²⁵ Ibid., p. 42.

²⁶ Ibid.

²⁷ Darwin (1998), p. 5.

²⁸ Ibid.

²⁹ Ibid., pp. 48-49.

³⁰ Ibid., p. 4.

³¹ Ibid, p. 10.

³² Canguilhem (2003), pp. 175-176.

³³ Lewontin (2000), pp. 44 and 47; See also Lewontin (1991), p. xv.

Lewontin observes that Darwin's distinction between organism and environment, or inside and outside, has been productive:

Darwin's alienation of the outside from the inside was an absolutely essential step in the development of modern biology. Without it, we would still be wallowing in the mire of an obscurantist holism that merged the organic and the inorganic into an unanalyzable whole.³⁴

Although Darwin's representation of the 'conditions of life' as a variety of external factors anticipated the role of environment with reference to a particular organism, it did not yet explain it. The physical conditions of life merely represented the raw material 'from which environments may be built'; environment being 'the penumbra of external conditions that are relevant to [an organism]'.³⁵ His discussion of external conditions also reinforced and facilitated the idea of environment as a place or space that exists separately from the individual organism and influences its existence.³⁶

1.2.2 The environment as space or location

Another traditional understanding of environment represents it as a space, a location, or a technological medium that living forms inhabit or through which they travel. This spatial connotation of the notion of environment can be productive. For example, it calls into question the largely artificial and conceptual limits and boundaries between entities through the contingency of the inside/outside distinction. However, this distinction must itself not be regarded as referring to actual locations. It is merely a useful tool to discuss the functioning of living processes (see para. 2.2.1 below). Nevertheless, the environment *can* take the form of a geographical space or location in a particular instance. The environment understood as a space is only one of many ways in which thought about the environment manifests itself. It is illustrative of a kind of thinking that relies on reference to individual entities or centres.

³⁴ Ibid., p. 47.

³⁵ Ibid., pp. 48-49.

³⁶ Ibid., p. 53. However, 'it is, in general, not possible to understand the geographical and temporal distribution of species if the environment is characterized as a property of the physical region, rather than of the space defined by the activities of the organism itself'.

The interest in the environment as space is influenced and reinforced by a recent focus on the transmission, distribution, and translation of objects.³⁷ Although such processes perhaps presuppose a certain notion of 'space', this notion does not correspond with traditional ideas of space as 'territory'. As Luhmann says: 'territoriality is an entirely atypical, rather exotic bounding principle, one that tends to disturb normal societal mobility'.³⁸ Space is no longer regarded as geographical, but as an active factor (or actor) in the transformation and mobilization of entities. Nevertheless, the interpretation of environment as space continues to rely on the identification and location of entities circulating *in* that space.

Canguilhem points out that the traditional notion of space does not fit comfortably with living processes in particular. Reference should be made instead to a 'topology', because traditional notions of space and distance are put into question by the self-generative character of '*vivants*'. Canguilhem observes:

[T]o understand the '*vivant*' one needs to refer to a non-metrical theory of space, this means a science of order, a topology ... A biological form, says Aristotle, is not a schema, it is not a geometrical form. This is true. Within an organism, considered in and for itself, there is no distance, the whole is everywhere present to its pseudo-parts. That which distinguishes the '*vivant*' is precisely this, to the extent that it is '*vivant*', it is not at a distance from itself.³⁹

The different notions of 'milieu' that will be addressed in the following paragraphs - Bernard's '*milieu intérieur*', von Uexküll's '*Umwelt*', and Luhmann's 'environment' - can easily be mistaken for representations of space. However, I argue that Bernard used the contingency of the inside/outside distinction in order to describe the self-regulation of organisms. Von Uexküll described the *Umwelt* not as space but as a set of signals whose existence and meaning depends on the value those signals have for a particular living being. Luhmann's notion of environment does not represent the 'in which' differentiation takes place. Rather, the environment 'takes place' itself because it is an effect of the continuous differentiation between system and environment. I argue that Luhmann's notion of environment does not rely on a centre of reference which it

³⁷ Thrift (2006). Thrift describes a relatively recent 'spatial turn' by reference to Latour's actor-network theory and Deleuze and Guattari's idea of 'plane'. However, Latour's ideas are arguably more about networks and processes of translation than about space, while Deleuze and Guattari's idea of 'plane' precisely challenges what they call 'territorialization'.

³⁸ Luhmann (1996), p. 195.

³⁹ Canguilhem (2002), pp. 362-363 (my translation).

surrounds but that the notion is used precisely to unseat such centres of reference. Besides, his theory is temporal rather than spatial.⁴⁰

Other theorists, such as Deleuze and Guattari, also refer to spatial notions such as the 'plane'. However, this notion is precisely employed to get away from what they call a 'territorialization of milieus'.⁴¹ Deleuze and Guattari use the notion of 'milieus' in order to focus on acceleration rather than location.⁴² How can the notion of environment be associated with action or movement rather than location?

1.2.3 *The environment and action*

According to Nietzsche, the life sciences of his time focused too much on the environment as a set of external conditions. He observed:

[T]he influence of external circumstances is overestimated by Darwin to a ridiculous extent: the essential thing in the life process is precisely the tremendous shaping, form-creating force working from within which *utilizes* and *exploits* 'external circumstances'.⁴³

It was these forces that required explanation rather than the idea of the environment as an amalgamation of external circumstances that influenced the individual organism. Nietzsche elaborated his own ideas on these forces by reference to Newton's notion of force in physics:

[T]he victorious concept 'force', by means of which our physicists have created God and the world, still needs to be completed: an inner will must be ascribed to it, which I designate as 'will to power', i.e. as an insatiable desire to manifest power; or as the employment and exercise of power, as a creative drive, etc. Physicists cannot eradicate action at a distance from their principles; nor can they eradicate a repellent force (or an attracting one) ... In the case of an animal, it is possible to trace all its drives to the will to power; likewise all the functions of organic life to this source.⁴⁴

Nietzsche developed his ideas on forces through his notion of 'will to power'. He represented this notion as an alternative to the forces in physics that, according to him,

⁴⁰ Luhmann (1996), p. 41, systems theory begins with 'the fact that nothing remains as it is'; *ibid.*, p. 385: 'Space is constituted ... by the assumption that two things cannot occupy the same space at the same time.'

⁴¹ Deleuze & Guattari (1999), p. 314.

⁴² *Ibid.*, p. 25: 'The middle is by no means an average; on the contrary, it is where things pick up speed. *Between* things does not designate a localizable relation going from one thing to another and back again, but a perpendicular direction, a transversal movement that sweeps one *and* the other away.'

⁴³ Nietzsche (1968), p. 344.

⁴⁴ *Ibid.*, pp. 332-333.

lacked motivation and creative potential. What Nietzsche calls 'will' can never be imagined as singular or as corresponding to the intention of a subject.⁴⁵ Rather, it signifies 'will upon will' or forces acting upon other forces.⁴⁶ Deleuze describes this as follows:

Every force is thus essentially related to another force. The being of force is plural, it would be absolutely absurd to think about force in the singular ... A plurality of forces acting and being affected at distance, distance being the differential element included in each force and by which each is related to others - this is the principle of Nietzsche's philosophy of nature. The critique of atomism must be understood in terms of this principle. It consists in showing that atomism attempts to impart to matter an essential plurality and distance which in fact belongs only to force.⁴⁷

The influence of Newton's physics on Nietzsche's ideas of force will become apparent in para. 2.1 below.

Foucault, in turn, was undoubtedly influenced by Nietzsche when he elaborated his notion of '*dehors*'.⁴⁸ Deleuze notes how this idea should be distinguished from space or exteriority.⁴⁹ It enables Foucault's idea of power as forces acting on, and affecting, other forces. Deleuze describes this as 'a physics of action, it is a physics of abstract action'.⁵⁰ The environment, once distinguished from its association with space or location, can now be interpreted as 'a set of actions upon other actions'.⁵¹

In a similar way, Luhmann employs the notion of environment in order to represent autopoietic reproduction as 'action out of action',⁵² thereby introducing a "subject-free" concept of action'.⁵³ In Nietzsche, Foucault, and Luhmann action can no longer be traced back to an individual. Their particular use of the notion of environment or 'milieu' is instrumental; it is no longer regarded as surroundings with reference to a centre but as a medium that facilitates action.

⁴⁵ Ibid., pp. 369 and 335: 'We cannot think of an attraction divorced from an *intention*. - The will to take possession of a thing or to defend oneself against it and repel it - that, we 'understand': that would be an interpretation of which we could make use. In short: the psychological necessity for a belief in causality lies in the inconceivability of an event divorced from intent.'

⁴⁶ Ibid., p. 347; See Pottage (1998b) for an exploration of this idea in Foucault and Luhmann.

⁴⁷ Deleuze (1983) pp. 6-7.

⁴⁸ Foucault (1986).

⁴⁹ Deleuze (1999), p. 72.

⁵⁰ Ibid., p. 60.

⁵¹ Ibid., p. 59, citing Foucault.

⁵² Luhmann (1996), p. 110.

⁵³ Luhmann (1996), p. 118.

As Deleuze says: 'But when there are only environments and whatever lies between them (*'milieux et des entre-deux'*) ... there is a liberation of forces which come from the outside and exist only in a mixed-up state of agitation, modification and mutation.'⁵⁴ While the environment as a physical space can be easily imagined, the environment understood as 'action out of action' or as forces that act upon other forces is more difficult to grasp.⁵⁵

PART II

2.1 A history of aether

2.1.1 *The dynamic origins of 'milieu'*

It would be difficult to claim that the notion of 'milieu' has always existed, or, by contrast, that it did not exist at all until a certain identifiable point in time.⁵⁶ However, it can at least be said that no particularly coherent concept of it existed before the eighteenth century. The question then is what made its subsequent emergence as a concept necessary or inevitable.⁵⁷ Canguilhem begins his inquiry by observing that the idea of 'milieu' was imported into the life sciences from mechanical philosophy, where it was first developed.

The thought that guided the mechanical philosophy of the seventeenth century, most famously elaborated by Descartes, was that reality was made up of material particles in motion; '[t]he moving particle was the ultimate term of explanation'.⁵⁸ However, certain phenomena - such as gravity, the cohesion of bodies, and 'capillary action'⁵⁹ - could not be explained solely by reference to individual particles. In traditional mechanical philosophy, therefore, such phenomena were 'explained away by some imagined mechanism'.⁶⁰ Although the workings of this mechanism remained unclear,

⁵⁴ Deleuze (1999), p. 73.

⁵⁵ Ibid., p. 62: with regard to relations of power or force, 'they are not 'localized' at any given moment ... they evade all stable forms of the visible and the articulable'.

⁵⁶ Cf. Müller-Wille and Rheinberger (2007), p. 8, with regard to heredity.

⁵⁷ Cf. Hacking (2002).

⁵⁸ Westfall (1971), p. 377.

⁵⁹ Ibid., p. 334.

⁶⁰ Ibid., p. 332.

explanations could avoid having to rely on notions such as attraction, which was regarded as 'occult' until Newton gave it scientific credibility.⁶¹

Newton first introduced the idea of forces of attraction and repulsion that did not emanate from a material particle and could not be identified with its motion, but could instead be regarded as 'external' to such a particle and as affecting its motion. Newton's shift in emphasis from the idea of force as a 'property of a body' or individual particle to an external force that impacted upon it,⁶² was achieved by what Luhmann would call a 'second-order' shift of perspective: 'In impact, the force of one body's motion functions in relation to the second body as the "external cause" ... Newton made the perspective of the second body his primary one'.⁶³ It should be noted that Newton's philosophy was still a traditional mechanical philosophy in the sense that he considered physical reality to be made up of particles in motion. However, his philosophy was revolutionary because it introduced the idea of forces of attraction and repulsion that acted upon each other and that affected the motion of individual particles.⁶⁴

The forces that Newton imagined and the processes that he sought to explain required a concept other than that of the individual material entity. As Canguilhem observes, this innovation was not required by the mechanical philosophy of Descartes for which particles acted directly upon each other.⁶⁵ Newton's idea of forces of attraction and repulsion was premised on the idea of 'aether', which was already in use in the mechanical philosophy of the time.⁶⁶ Newton gave the idea a central role in his natural philosophy. It allowed him to shift focus from the individual particle to the idea of active forces. Moreover, the idea of aether allowed him to explain specific processes such as 'electrical attraction, gravitation, the cohesion of bodies, elasticity, sensory perception, animal motion, heat, and, of course, optical phenomena'.⁶⁷

⁶¹ Ibid., p. 377.

⁶² Ibid., p. 323.

⁶³ Ibid., p. 344.

⁶⁴ Ibid., p. 378 and 323: Leibiz' idea of '*vis viva*' preceded Newton's ideas: 'Not matter in motion, but force is the fundamental category of being.'

⁶⁵ Canguilhem (2003), p. 166.

⁶⁶ Westfall (1971), p. 336.

⁶⁷ Ibid., p. 364.

2.1.2 *The aether as 'milieu'*

At least initially, Newton regarded aether as the material fluid or substance from which all particles were formed.⁶⁸ He represented it as a material environment and as a medium that both surrounded particles and pervaded them.⁶⁹ I shall return to this ambiguity below, because - according to Canguilhem - it came to constitute an important characteristic of the notion of 'milieu' itself. It should be pointed out that the aether as medium did not represent the space *in which* processes were thought to take place; Newton's notion of aether as milieu should be distinguished from his notion of space.⁷⁰ He regarded the latter as a more static notion that did not contribute in the same way as aether to the functioning of processes themselves.

Westfall notes that Newton's philosophy changed around 1679, specifically with regard to the existence of - and the role fulfilled by - aether.⁷¹ Indeed, Newton came to reject the existence of aether after performing an experiment that led him to the conclusion that the substance of aether was so thin that it provided no resistance at all. He concluded that, even if it existed, the notion was not much use to him.⁷² He went on to claim that aether did not exist, but that '[b]odies act on each other at a distance, attracting and repelling, as he put it, "with a certain large force"'.⁷³ He refers here to forces between particles without referring to aethereal fluids as mediating such forces, thereby 'abstracting the concept of force from the question of its ultimate causation'.⁷⁴

Years later, however, the notion of aether reappeared in his work, albeit in a slightly different form. He still left the question of ultimate causation of forces open, but said - more generally - that attractions and repulsions can be caused, for example, through 'the impulses of an intervening medium'.⁷⁵ The reason for giving aether a place in his philosophy once again was that Newton did not wish to be perceived as attributing

⁶⁸ Ibid., p. 365.

⁶⁹ Canguilhem (2003), p. 167.

⁷⁰ Iliffe (2007), p. 64.

⁷¹ Westfall (1971), p. 391.

⁷² Iliffe (2007), p. 93.

⁷³ Westfall (1971), p. 377, citing Newton; *ibid.*, p. 378, the 'central proposition' of Newton's dynamic mechanical philosophy is described in Query 31 of *Opticks*: 'Have not the small Particles of Bodies certain Powers, Virtues, or Forces, by which they act at a distance, not only upon the Rays of Light for reflecting, refracting, and inflecting them, but also upon one another for producing a great Part of the Phaenomena of Nature?'; Latour (2002), p. 222, recovers the idea of 'action at a distance': 'a cycle of accumulation that allows a point to become a *centre* by acting at a distance on many other points'.

⁷⁴ Westfall (1971), p. 398.

⁷⁵ Ibid., p. 386.

certain processes to individual particles themselves: 'to shew that I do not take Gravity for an essential property of Bodies, I have added one Question concerning its Cause'.⁷⁶

Newton justified the reintroduction of aether as the milieu that made 'action at a distance' possible in the following terms:

Tis unconceivable that inanimate brute matter should (without ye mediation of something else wch is not material) operate upon & affect other matter without mutual contact ... That gravity should be innate inherent & essential to matter so yt one body may act upon another at a distance through a vacuum without the mediation of anything else by & through wch their action or force may be conveyed from one to another is to me so great an absurdity that I believe no man who has in philosophical matters any competent faculty of thinking can ever fall into it.⁷⁷

Aether was now regarded as immaterial rather than material; it was 'an infinite and omnipresent spirit in which matter is moved'.⁷⁸ It has been noted that this notion of aether has some affinities with Newton's conception of God as a 'Divine Medium who moves bodies as though they attract each other according to exact mathematical laws'.⁷⁹ Canguilhem picks up on the sense in which the medium represents a kind of 'mystical intuition' of how a force could be central and omnipresent at the same time.⁸⁰

For Newton, aether made the cohesion of bodies and their action at a distance possible.⁸¹ Canguilhem only focuses on Newton's reinterpretation of aether and describes it as 'that fluid vehicle of action at a distance'.⁸² However, aether cannot be regarded as a mere 'vehicle of action', rather - as Westfall observes - 'the aether embodied the very problem of action at a distance which it pretended to explain'.⁸³

The notion of aether as milieu was used by Newton in order to explain and make action at a distance possible. More specifically, it was introduced in order to explain how action could be transmitted, how it could act, and how it could affect. Nowhere in Newton's work is the notion of action precisely defined. The idea of action was associated with the idea of forces as 'active principles'.⁸⁴ In other words, action was not attributed to an individual entity in the way that motion was previously attributed to the

⁷⁶ Ibid., p. 392.

⁷⁷ Ibid., p. 396.

⁷⁸ Ibid., p. 399, citing Newton.

⁷⁹ Ibid., p. 400.

⁸⁰ Canguilhem (2003), p. 195.

⁸¹ Westfall (1971), p. 394.

⁸² Canguilhem (2003), p. 167.

⁸³ Westfall (1971), p. 395.

⁸⁴ Ibid., p. 548.

individual particle. Newton emphasized activity rather than a traditional idea of action with reference to a centre or interaction between particles.⁸⁵

The notion of aether came to account for processes or actions where individual material particles did not come into direct contact and yet affected each other or acted upon each other. Since Descartes, action had been explained only in terms of some sort of direct contact or collision of individual entities so there was no real understanding of how bodies might interact or communicate without colliding. Once the idea of 'action at a distance' was introduced, it became increasingly difficult to explain action with reference to individual entities or particles in isolation. Action or interaction at a distance could not be explained by imagining an entity drawing its own force, and the capability to transmit it, entirely from itself.

Newton found an explanation for the possibility of indirect action in the notion of aether. Although the existence of aether was questioned by Newton himself and by the scientific community, this did not prove to be an obstacle to the survival of the concept of the 'milieu' as medium. Without such a concept it was difficult even to begin to imagine forces acting upon each other.

2.1.3 '*Milieu*' as medium

Here, we return to the essential ambiguity of the notion of 'milieu' as signifying both medium and environment. Canguilhem observes that this ambiguity might be traced back to Newton and his representation of aether.⁸⁶ Although the idea of 'milieu' was introduced by Newton, the term first emerged - according to Canguilhem - in the *Encyclopédie* of Diderot and D'Alembert.⁸⁷ They translated Newton's original notion of 'medium' into the French '*milieu*' and described it as 'a material space in which a body

⁸⁵ Ibid.

⁸⁶ Ibid., 167: 'The fluid is the intermediary between two bodies, it is their milieu; and insofar as it penetrates all these bodies, these bodies are situated at its centre.' (My translation)

⁸⁷ Ibid., p. 166: Canguilhem notes how the term emerged in literature; Feldhoff (1980), p. 1394 cites Balzac from the Preface to the '*Comédie humaine*' (1842): 'Does society, on the basis of the Milieux where his actions develop, not turn man into as many different men as there are zoological varieties?' (My translation).

is placed'.⁸⁸ Canguilhem believes that this interpretation of 'milieu' as distinct from the individual leads to an erosion of the notion's relativity.⁸⁹

Imagined as a 'vehicle for action', aether was primarily regarded as somehow transporting or mediating the action of individual particles. According to Newton's original description, the medium surrounded individual particles and its main function was to act as an intermediary between entities. This seemed to suggest that the existence of the medium was distinct from that of the individual particles. But how would the medium have a distinct existence and at the same time be able to transport action and affect a particle's motion? The answer was to say that the medium pervaded the entities for which it was the medium. As Newton put it, aether is 'interwoven with bodys ... & promotes their actions being a tender ferment'.⁹⁰ He also said 'it is the most commonly held opinion of philosophers in this age that there is a certain aethereal medium extremely rare and subtile, which freely pervades the pores of all bodies'.⁹¹

Physical entities were now seen as immersed in the medium rather than merely surrounded by it. Only in this way could one explain how the medium enabled interaction between entities. But if aether pervaded bodies, how was action generated in the first place? It was no longer clear that action could be directly attributed to an individual entity or its particles in isolation, since action was no longer identified with motion generated by individual particles. The medium as vehicle for action did not merely prompt or stimulate a potential for action that was innate to the individual. I argue that it was the notion of the medium itself that made action - and action at a distance - possible.

Although Newton never identified the cause of forces and processes that could not be explained by traditional mechanical philosophy, it was clear that aether as a medium did not merely represent the inert space in which action was acted out or where forces exerted themselves. In seeking to explain the formative and transformative impact of individuals on each other by reference to the notion of forces and action at a distance, I believe that the medium gradually came to be regarded as representing such action rather than merely transporting it.

⁸⁸ Feldhoff (1980), p. 1393.

⁸⁹ Canguilhem (2003), p. 167.

⁹⁰ Iliffe (2007), p. 60.

⁹¹ Westfall (1971), p. 376, citing Newton.

The ambiguity of aether as milieu arose from the fact that Newton, as a mechanical philosopher, still reasoned from individual particles as centres of reference and that he understood aether as relative to such centres. At the same time, however, he introduced aether as an omnipresent medium without any fixed points of reference. Quite simply, aether was meant to explain how action acted between individuals and how action acted.

Canguilhem emphasizes the ambiguity of 'milieu' by observing: 'one must choose between two theories of milieu ... [it is either] a centred and qualified space where the "*mi-lieu*" is centre; or a decentred and homogeneous space where the "*mi-lieu*" is an intermediary field'.⁹² The former represents 'milieu' as environment and the latter represents it as medium. 'Milieu' as environment refers to, and relies on, an individual entity. It is already differentiated from the individual and structured with reference to it. The relation between individual and environment is represented as being one of differing degrees of interdependence.

However, the idea of milieu as medium paints a different picture. It does not represent an outside in relation to an inside or surroundings with reference to a centre. Rather, the milieu is characterized by its relativity and potential for action rather than by its location. This is Newton's medium represented as forces acting upon other forces without relating such forces or action back to centres or individual particles. As Canguilhem says, this idea of 'milieu'

can only be interpreted as that which is indefinitely negated by exteriority. The now refers back to the before, the here refers back to the there, and so it goes on without interruption. The milieu is truly and purely a system of '*rapports sans supports*'.⁹³

This notion of 'milieu' as medium introduced dynamics, activity, force, and contingency into physics and unseated the privileged role of individual particles in motion that previously characterized mechanical philosophy. However, according to Canguilhem, the idea of 'milieu' was subsequently employed in physics in order to dissolve organic individuals in 'the anonymity of universal elements and movements'.⁹⁴ The notion of 'milieu' as medium, therefore, seems to challenge biological specificity rather than contribute to a biological concept of environment.

⁹² Canguilhem (2003), p. 193.

⁹³ Canguilhem (2003), p. 172 (my translation).

⁹⁴ Ibid.

2.1.4 *'Milieu' as environment*

The original notion of 'milieu' was purposefully described by Newton as dynamic in order to explain and enable action at a distance. However, when the notion was introduced into biology it gradually lost its dynamic and ambiguous character. The milieu was no longer associated with forces acting upon other forces but was, instead, recruited to sustain the notion of the individual organism. Canguilhem attributes the introduction of the notion of 'milieu' into biology to Lamarck.⁹⁵ However, he also observes that it might have been Newton himself who first applied the notion of 'milieu' to organic processes.⁹⁶

Newton employed the notion of aether in order to explain the physiological phenomena of muscles contracting in the eye when exposed to a source of light. He believed that muscles contracted and dilated in accordance with the varying densities of the aether that pervaded them.⁹⁷ Since aether as medium or milieu pervaded all material bodies, it did not distinguish between the organic and the inorganic.⁹⁸

Lamarck was influenced by Buffon in his elaboration of the notion of 'milieux', to which he always referred in the plural form.⁹⁹ Buffon was well known for reformulating biological problems by employing Newton's physics.¹⁰⁰ Newton represented the milieu as being directly involved in the functioning of processes rather than as a mere external influence on such processes. However, Lamarck represented 'milieux' - such as water, air, and light - as external circumstances to which an organism had to adapt if it was to survive.¹⁰¹ The milieu was represented as distinct from the individual organism and as indifferent to it.¹⁰²

According to Canguilhem, Comte first characterized the milieu as an abstract and singular notion. He also represented the relation between organism and milieu as a

⁹⁵ Ibid., p. 166.

⁹⁶ Ibid., p. 167.

⁹⁷ Iliffe (2007), pp. 63, 64; Canguilhem (2003), p. 167.

⁹⁸ Canguilhem (2003), pp. 167-168. However, Canguilhem believes that Newton regarded this as the first example of the effect of the physical milieu on an organic process.

⁹⁹ Ibid., pp. 166-168.

¹⁰⁰ Casini (1992).

¹⁰¹ Canguilhem (2003), p. 168.

¹⁰² Ibid., p. 174.

dialectic or as a '*conflit de puissances*'.¹⁰³ Canguilhem believes that Comte took his inspiration from Newton's ideas on action and reaction.¹⁰⁴ At the same time, Comte used the relation between organism and milieu to negotiate the boundaries of biology as a discipline. The concept of 'milieu' implicitly signified the impossibility of isolating biology from other disciplines, most notably the social sciences, while the concept of organism signified the autonomy of biology.¹⁰⁵

Comte described the environment as neither hostile to the organism nor as determining it completely.¹⁰⁶ However, despite the subtlety of his notion of 'milieu' as environment, it still represented a collection of external circumstances that supported the existence of the individual. The role of milieu was reduced to that of a source of information or energy, rather than a medium enabling action. The milieu came to be referred to as '*circonstances*' or '*ambiance*', both terms corresponding to the notion of environment as surroundings with reference to a centre.¹⁰⁷

The abstraction and reduction of 'milieu' as environment coincided with the emergence of the image of the individual as a more or less self-contained centre. Action was attributed to individual entities themselves. Such entities no longer relied to any significant extent on a milieu that surrounded and pervaded them for their action, transformation, and communication with other individuals. The interpretation of 'milieu' as medium or as a relative '*entre-deux centres*' shifted to the idea of 'milieu' as environment or centre in itself; its most prominent characteristic being its reference to the privileged centre of the individual.¹⁰⁸

In conclusion, the emergence of the concept of 'milieu' was a response to the dissatisfaction with the focus on distinct physical entities and the lack of explanation for their potential to act at a distance. From the moment of its emergence, the notion of 'milieu' relied for its dynamic character on a certain ambiguity and relativity. Rather than undermining the concept by compromising its clarity, I believe that this ambiguity explains the resilience and productivity of the concept. Although the notion of 'milieu' initially emerged to explain the interaction between individual entities, paradoxically, it

¹⁰³ Ibid., 170.

¹⁰⁴ Ibid.

¹⁰⁵ Canguilhem (2002), p. 65.

¹⁰⁶ Ibid.

¹⁰⁷ Canguilhem (2003), p. 172.

¹⁰⁸ Ibid., p. 167.

made the association of action with individual particles in isolation less plausible. Instead, a central role was attributed to the milieu as medium that not merely facilitated action but explained and constituted it; the milieu did not represent a definable space 'between' entities that was otherwise passive.

The notion of 'milieu' underwent a significant transformation two centuries later. Claude Bernard enriched the notion by developing his idea of a '*milieu intérieur*'. A few decades later, the Estonian biologist Jacob von Uexküll described the 'milieu' as a series of links, signals, and perceptions linked to other signals. Bernard and von Uexküll not only altered the notion of 'milieu' conceptually; they also reintroduced ambiguity and activity. These transformations of the notion of 'milieu' also had significant consequences for how the relation between individual and environment was imagined.

2.2 New ways of imagining 'milieu'

2.2.1 The '*internal milieu*'

After Comte, the dominant view of 'milieu' was that of a combination of external circumstances in relation to an individual. In the middle of the nineteenth century, Bernard introduced a new idea of 'milieu'. Although his notion of the '*milieu intérieur*' was revolutionary - it would even inspire writers and social scientists - the significance and productivity of the concept seems to have 'almost completely escaped his contemporaries'.¹⁰⁹ It seems that some regarded the notion as nothing more than a 'picturesque expression'; it was not included in the list of Bernard's great achievements that were remembered at his funeral ceremony.¹¹⁰

Bernard's notion of an 'internal milieu' first emerged in 1855 with his characterization of the glycogenic function of the liver as 'internal secretion'.¹¹¹ The term '*milieu liquide intérieur*' appeared for the first time in his notebooks a few years later. Bernard claimed: 'I believe that I am the first to have expressed this idea clearly and to have insisted on it in order to make the exercise of experimentation on living beings more

¹⁰⁹ Halpern (1967), p. 5. (My translation).

¹¹⁰ Ibid.

¹¹¹ Canguilhem (2002), p. 287.

understandable'.¹¹² So the notion of the 'internal milieu' was introduced not only as a means of explaining the functioning of organisms; it provided a means of investigating the inner sanctum of such organisms through the new experimental method that Bernard proposed. As Canguilhem observes: 'Let us insist on this point: it is the *concept* of the "milieu intérieur" that serves as the theoretical foundation for the *technique* of physiological experimentation'.¹¹³ Bernard recorded, in his notebook, his dream of 'strolling, cain in hand, in the blood' - in the liquid internal milieu - to watch up close how cells live.¹¹⁴

The concept of an interior milieu was a response to what Bernard saw as an extensive focus on the milieu as exterior environment, for the simple reason that the external milieu was immediately visible.¹¹⁵ Bernard argued - against the prevailing view - that the milieu as exterior environment does not explain or determine the functioning of the individual.¹¹⁶ In seeking to understand living organisms, it would be a mistake to focus on how organisms live 'in' an exterior environment which regulates their functions. Bernard believed that the external environment is, nevertheless, indispensable for the manifestation of an organism.

According to Bernard, the conditions of life are neither located in the organism or its internal milieu, nor in the external environment. Rather, these conditions continuously emerge through the interaction of both 'milieux':

The elementary parts of beings, the constitutive elements that are truly endowed with life, the histological cells are not abandoned and left bare in a world that surrounds them. They are submerged in the 'milieu intérieur' which envelops them, separates them from the outside, and which serves as an intermediary between them and the cosmic milieu.¹¹⁷

Bernard describes this process of interaction, made possible by the ambiguity of the notion of 'milieu' itself, as a 'double condition of existence'.¹¹⁸

¹¹² Bernard (1865), p. 129 (my translation).

¹¹³ Canguilhem (2002), p. 148 (my translation).

¹¹⁴ Bernard (1965), p. 24 (Introduction M.D. Grmek).

¹¹⁵ Bernard (1865), p. 107: 'We suppress the internal milieu in our explanations, only to see the external milieu which is right under our eyes.' (My translation)

¹¹⁶ Halpern (1967), p. 6, citing Bernard: 'that which we call the surrounding world is not the real place where their existence is immediately accomplished'. (My translation).

¹¹⁷ Ibid. (my translation)

¹¹⁸ Bernard (1865), p. 129.

His idea of an internal milieu fulfilled another function: it allowed him to maintain an ambiguous position with regard to vitalism. On the one hand, Bernard refuted vitalism by demonstrating that there was a milieu *inside* the living organism.¹¹⁹ This meant that such an organism was ruled by the same physical laws as the external milieu. On the other hand, however, the internal milieu was specific to living beings and had its own particular characteristics. It could, therefore, not be regarded as the extension of the external milieu within the individual.

The particularity of living processes was affirmed by Bernard's statement that although one could investigate matter by considering only one milieu (the external milieu), an investigation into living organisms required the consideration of two milieus: one external and one internal.¹²⁰ So the idea of the internal milieu promoted the autonomy of biology as a discipline by distinguishing biological milieus from the 'milieu-as-aether' of physicists.¹²¹ As Bernard observed in promoting his technique of vivisection: 'Ancient science could only conceive of an external milieu; but it is necessary, in order to found an experimental biological science, also to conceive of a "milieu intérieur"'.¹²²

The notion of an internal milieu was made possible by the ambiguity that characterized the notion of 'milieu' ever since its use by Newton. The distinction between an internal and an external milieu is drawn within the notion of 'milieu' itself. Although the idea of an 'internal milieu' seems paradoxical, the external environment is not somehow 'integrated' into the organism. Rather, the internal milieu is the organism's own interpretation of the external environment within itself. The organism functions through this continuous self-reference and external reference, even if the distinction between 'self' and 'external' is drawn within - and by - the organism itself.

This is what Luhmann describes as the 'reentry of the form into the form'.¹²³ The distinction between system and environment is drawn by the system, rather than by the environment. This explains Bernard's argument that the main difference between the internal and external milieu is that, whereas the external milieu is absorbed and

¹¹⁹ Ibid., p. 108.

¹²⁰ Ibid, p. 110; Bernard (1965), pp. 243-247: M. Drazen Grmek on Bernard's conflicting thoughts on vitalism.

¹²¹ Prochiantz (1993), p. 271.

¹²² Canguilhem (2002), p. 148.

¹²³ Luhmann (1998), p. 32.

represented within the internal milieu the latter is not absorbed in the former.¹²⁴ The organism maintains a representation within itself of the external environment without losing its self-containment and self-regulation. As Luhmann points out, the reentry of form into form leads to the paradox that ‘the external can only be attained from within’.¹²⁵ In other words, the organism only has indirect access to the external environment by reference to its internal milieu.

The idea of the internal milieu makes it possible for a living process to be regarded as a self-regulating ‘whole’ or unity. As Canguilhem describes, with reference to the example of blood, it is this ‘through which the organism applies to itself, is turned in on itself, is in relation to itself’.¹²⁶ And as Bernard himself says: ‘All vital mechanisms, however varied, have but one objective, that of maintaining the unity of life functions in the internal medium’.¹²⁷ Bernard, therefore, reconceptualizes the organism through his idea of the internal milieu that makes self-regulation possible.

Whereas Comte represented the organism as being regulated through an abstract external environment, Bernard represents the organism as being regulated through its own internal milieu. Canguilhem believes that an intellectual lineage can be traced from Bernard’s notion of the internal milieu to the cybernetics of Wiener that relies on the notion of the feedback mechanism.¹²⁸ Bernard called the internal milieu ‘a true *product of the organism*’.¹²⁹ Whereas the external milieu was common to all creatures, the internal milieu was created by the organism itself and was therefore particular to it.

2.2.2 The ‘associated milieu’

The idea of a milieu that is particular to an individual was given renewed impetus by von Uexküll in 1934. Deleuze and Guattari observe how ‘the milieu assumes a third figure here: it is no longer an interior or exterior milieu, even a relative one, nor an intermediate milieu, but instead an “*annexed or associated milieu*”’.¹³⁰ In his work

¹²⁴ Bernard (1865), p. 130.

¹²⁵ Luhmann (1998), p. 34.

¹²⁶ Canguilhem (2002), p. 148 (my translation).

¹²⁷ Jacob (1976), p. 189, citing Bernard.

¹²⁸ Canguilhem (2000), p. 82.

¹²⁹ Bernard (1865), p. 110.

¹³⁰ Deleuze & Guattari (1999), p.51.

‘*Streifzüge durch die Umwelten von Tieren und Menschen*’,¹³¹ von Uexküll challenged the dominant view of the functioning of organisms, of milieu as environment, and of the relation that was presumed to exist between organism and environment. At the time, the organism was often represented as a machine - in the strictly mechanical sense - that responded to external influences through reflexes, while the environment was regarded as the combination of external influences determining the existence and functioning of the organism.

The recent interest in von Uexküll’s work is noteworthy in itself. Philosophers such as Agamben and Deleuze refer to his ideas at various instances in their work.¹³² This suggests that his ideas, with their rather specific object of inquiry - living beings and their environments - represent a new perspective whose productivity is not necessarily limited to the life sciences. Although reasons for referring to von Uexküll’s work may differ, the interest that philosophers share in his work can perhaps be attributed to two of its main characteristics.

First, his theory is radically non-anthropomorphic. As Agamben says, von Uexküll’s well-known description of the tick and its particular milieu - as well as the illustrations of the particular perspectives of animals and their worlds included in his book - represent a ‘high point of modern antihumanism’.¹³³ Second, von Uexküll breaks with the traditional idea that there is one world, one space, and one time that all species inhabit. Rather, he represents the image of an infinite variety of worlds that are all linked harmoniously - the analogy is made to a musical symphony - but that are at the same time reciprocally exclusive.¹³⁴

Von Uexküll did not refer to the notion of ‘milieu’ as such. Rather, he developed his own notion of ‘*Umwelt*’.¹³⁵ Although he called his theory ‘*Umweltlehre*’, von Uexküll’s focus was initially on the individual organism. He emphasized that “‘*Umweltlehre*’ is a kind of externalized study of the soul that is performed from the point of view of the

¹³¹ J. von Uexküll (1957); for a short biography, see T. von Uexküll (1982), p. 1 and Agamben (2004), p. 39.

¹³² For example: Deleuze & Guattari (1999), pp. 51, 257 and 314; Deleuze (1988), p. 185 (n.33); Agamben (2004), pp. 39-47.

¹³³ Agamben (2004), p. 45.

¹³⁴ Deleuze (1988), p. 185 (note 33): Deleuze finds this especially productive and compares von Uexküll’s ideas to Leibniz’s ‘monads’.

¹³⁵ J. von Uexküll (1909).

observer. It is not an analysis of the “I”.¹³⁶ Von Uexküll focuses on the ‘*Umwelt*’ because an individual organism can only be identified as such by an observer, or rather, through its *Umwelt*.

An organism cannot be regarded as an isolated entity that responds to an external environment through reflexes. The behaviour of living beings should not be regarded as ‘mere movements or tropisms, but they consist of perception (*Merken*) and operation (*Wirken*); they are not mechanically regulated, but meaningfully organized’.¹³⁷ In other words, the individual organism cannot be explained by reference to mechanical philosophy. When the receptor organs of the individual react to a signal from its *Umwelt*, this does not constitute a reflex but a certain sensibility guided by a need.¹³⁸

Von Uexküll distinguishes between the ‘*Umwelt*’ of the individual and the ‘*Umgebung*’. The latter represents the physical environment and, according to von Uexküll, merely translates the human belief that there exist objective realities in the world. Such a belief is necessary for the individual to function.¹³⁹ Von Uexküll says:

[N]o longer does man move together with a space that loyally follows him, as seemed to be the case. Rather, man moves in a space that is at rest and that has completely severed itself from him and has its own centre. Space, then, has become autonomous like the objects in it.¹⁴⁰

If an external environment seemingly exists, it is only because of the similarity of the ‘*Sinnesphären*’ of different individuals.¹⁴¹ The environment as *Umwelt* or ‘associated milieu’ cannot be equated with this exterior environment, because no such physical environment is thought to exist. Rather, the world is made up of subjective realities.¹⁴² These milieus, or ‘*Umwelten*’, co-exist and perhaps in certain instances overlap but they never entirely coincide.

¹³⁶ J. von Uexküll (1936), p. 25 (my translation).

¹³⁷ J. von Uexküll (1982), p. 26.

¹³⁸ Canguilhem (2003), p. 197: Canguilhem explores this by referring to ‘*sens*’ and ‘*besoin*’.

¹³⁹ J. von Uexküll (1936), pp. 16-17.

¹⁴⁰ Ibid., p. 16 (my translation).

¹⁴¹ Ibid., pp. 14-15: ‘Because the “*Sinnesphären*” of individuals are alike in all main aspects, the objects in their particular “*Umwelten*” are also alike. From this, man has too hastily concluded that the objects are themselves realities that exist independently of the subject ... This presupposition is ... incorrect’. (My translation).

¹⁴² Ibid., pp. 18-20: von Uexküll describes how he himself believed in the existence of an objective environment until, while on holiday in his Italian villa, he heard three entirely different descriptions of the Bay of Naples: one from a guidebook, one from a native to the area, and one from a ‘bored American tourist’. This occurrence made him doubt the existence of a single objective environment.

Von Uexküll describes how these *Umwelten* themselves do not exist objectively; the aspects of - and objects in - them are only actualized when they are 'transformed into perceptual cues or perceptual images and invested with a functional tone'.¹⁴³ The *Umwelt* is, therefore, not a place but a set of signals that enables the perception and action of individual organisms (that are themselves - in turn - regarded as a combination of perception and operation). The *Umwelt* is a conjunction of the perceptual and operational world because it combines signals with the actions that are triggered by the perception of those signals.¹⁴⁴

Deleuze and Guattari point to the 'active, perceptive, and energetic characteristics' of the 'associated milieus' described by von Uexküll.¹⁴⁵ Rather than constituting places or parts of a physical environment, these milieus only exist as senses, signals, and cues. As von Uexküll says, the *Umwelt* is a "*Sinnesinsel*" that envelops every human being like a piece of clothing ... it fragments into different "*Sinnesphären*".¹⁴⁶ It is constituted by a reduced set of signals or sensibilities, namely the ones that matter for the organism.

Von Uexküll observes with regard to his famous example of the life of the tick, who only responds to specific signals in its environment rather than to the forest in its entirety: 'the very poverty of this world guarantees the unfailing certainty of her actions'.¹⁴⁷ The complexity of the *Umwelt* is necessarily reduced because '[e]ach *Umwelt* forms a closed unit in itself, which is governed, in all its parts, by the meaning it has for the subject.'¹⁴⁸

2.2.3. *The influence on - and of - the 'associated milieu'*

The idea that the *Umwelt* can only be understood through the meaning that it has for a particular individual was inspired by the philosophy of Kant. Von Uexküll observes:

¹⁴³ J. von Uexküll (1957), p. 72.

¹⁴⁴ J. von Uexküll (1982), pp. 31 and 33: von Uexküll refers to a 'functional circle'; Cobley (2001), p. 281.

¹⁴⁵ Deleuze & Guattari (1999), p. 51.

¹⁴⁶ J. von Uexküll (1936), p. 12 (my translation).

¹⁴⁷ J. von Uexküll (1957), p. 12. See also Canguilhem (2003), pp. 186-187; Agamben (2004), pp. 45-47; Deleuze & Guattari (1999), pp. 51 and 257; Deleuze (1988), p. 122.

¹⁴⁸ J. von Uexküll (1982), p. 30; Cobley (2001), p. 280, 281: von Uexküll is regarded as the founder of bio-semiotics.

without a living subject, there can be neither space nor time - with this, biology has ultimately established its connection with the doctrine of Kant, which it intends to exploit in the *Umwelt* theory by stressing the decisive role of the subject.¹⁴⁹

Von Uexküll observes how Kant regarded space as a human '*Anschauungsform*'.¹⁵⁰ This means that space only appears in a form particular to the individual; von Uexküll takes from this the idea that there is not one world and one time for all living beings. Kant described space as that which cannot be derived from experience but makes experience possible. However, space is not a category or a concept but an intuition, because 'no conception, as such, can be so conceived, as if it contained within itself an infinite multitude of representations'.¹⁵¹ The notion of space, as Kant represents it, depends on the intuition of the subject.

The thematization of the environment as a static space that exists in relation to a subject is often attributed to Kant. It could be argued that, when the subject became the centre of reference, the role of milieu as facilitating action - described above in relation to Newton - was neutralized. Bergson criticized the Kantian idea of space in relation to living beings.¹⁵² However, von Uexküll makes productive use of Kant's notion of space in relation to the subject by taking the subjective structuring of the milieu seriously.

Von Uexküll's ideas about individual and environment have significant consequences for the relationship that was previously thought to exist between them. Living organisms do not interact with an objective external environment, or with animals and objects in that environment. Rather, they respond to certain signs or '*Merkmale*' of its *Umwelt*. The idea of a milieu that is construed by the organism itself and to which it continuously refers can be likened to Bernard's idea of the internal milieu. Indeed, the interaction between *Umwelt* and *Umgebung* is similar to Bernard's '*double condition d'existence*' (see para. 2.2.1 above). If neither individual nor environment can be clearly distinguished as isolated entities, then the relation between individual and environment cannot exist in any traditional sense.

Von Uexküll regards milieu or environment as links or networks between signals and perceptual organs. As such, it is not the environment that gives rise to - or determines -

¹⁴⁹ J. von Uexküll (1957), p. 13.

¹⁵⁰ J. von Uexküll (1936), p. 16; see T. von Uexküll (1982), p. 9, on Kant's influence.

¹⁵¹ Kant (2003), p. 24.

¹⁵² Bergson (1908), p. 222; see also Gayon (2005), p. 54.

the living organism. Rather, the organism gives rise to itself and - in doing so - to its particular environment. As von Uexküll says: 'As the spider spins its threads, every subject spins his relations to certain characters of the things around him, and weaves them into a firm web which carries his existence.'¹⁵³ So one can say of von Uexküll's example of the tick that 'the tick *is* this relationship; she lives only in it and for it'.¹⁵⁴ Agamben points out that this relation between organism and *Umwelt* is much more intimate and rich than the traditional idea of a relation between organism and environment.

The influence of von Uexküll's notion of *Umwelt* can be distinguished in Canguilhem's observation that

the environments in which the living beings find themselves are carved out by them, centered on them. In this sense the organism is not thrown into an environment to which he must submit, but he structures his environment at the same time that he develops his capacities as an organism.¹⁵⁵

Goldstein was critical of von Uexküll's ideas in his work *Der Aufbau des Organismus* and refined them in two significant ways.¹⁵⁶ First, Goldstein clarifies that there is no pre-existing *Umwelt* for each organism. Rather, the *Umwelt* emerges only as the organism lives and asserts itself. So the environment is 'by no means something definite and static but is continuously forming commensurably with the development of the organism and its activity'.¹⁵⁷ Goldstein refers to this continuous process of development and differentiation as '*Auseinandersetzung*'.¹⁵⁸ Varela describes the simultaneous emergence of organism and environment as 'mutual definition'.¹⁵⁹

¹⁵³ J. von Uexküll (1957), p. 14.

¹⁵⁴ Agamben (2004), p. 47.

¹⁵⁵ Canguilhem (1978), p. 177.

¹⁵⁶ Canguilhem (2003), p. 184 (n. 1), describes Goldstein's criticism as follows: 'By not wishing to distinguish the *vivant* from its environment, every inquiry into relations becomes in a way impossible. Determination disappears and is replaced by reciprocal penetration; taking account of the totality kills knowledge'. (My translation).

¹⁵⁷ Goldstein (1995), p. 85.

¹⁵⁸ Canguilhem (2003), p. 187. Goldstein possibly used this term in the manner in which Heidegger employed it in the mid 1930s in his lectures on Nietzsche. Gasché (2007), p. 104: Heidegger said 'As Heraclitus thinks it, struggle first and foremost allows what essentially unfolds to step apart in opposition [*lasst im Gegeneinander das Wesende allererst auseinandertreten*] ... In such stepping apart [*Auseinandertreten*], clefts, intervals, distances, and joints open themselves. In con-frontation [*Auseinandersetzung*], world comes to be.'

¹⁵⁹ Varela (1991), p. 85: 'the important distinction between the environment *of* the living system as it appears to an observer and without reference to the autonomous unity - which we shall call hereafter simply the *environment* - and the environment *for* the system which is defined in the same movement that gave rise to its identity and that only exists in that mutual definition - hereafter the system's *world*.'

Second, for Goldstein the question of the direction of action - that was also raised by Nietzsche - as the 'essential characteristic of every vital phenomenon' remains.¹⁶⁰ The question is, then, whether such action is directed by the environment or whether it is 'effected through a certain determination and force issuing from the organism itself'.¹⁶¹ Goldstein observes:

[O]ne could say that the environment emerges from the world through the being or actualization of the organism. Stated in a less prejudiced manner, an organism can exist only if it succeeds in finding in the world an adequate environment - in shaping an environment.¹⁶²

The central problem is that the environment exists by virtue of the activity of the organism and the organism can only exist as such with reference to an environment. Deleuze and Guattari address this question when they observe that 'the associated milieus are closely related to organic forms. An organic form is not a simple structure but a structuration, the constitution of an associated milieu.'¹⁶³ The idea of a constitutive relationship in which no clear centre of action can be distinguished demonstrates how action is not always easily attributable to a centre.

The ideas of Bernard, von Uexküll, and Goldstein changed the ways in which 'milieu' was envisaged. Some of their ideas were taken up by Luhmann in his theory of social systems, notably the idea of an internal environment and an environment that is relative to the individual. Luhmann also represents individual/environment not as a relation but as a continuous process of differentiation that relies on signals, irritations, and communication. The perception of a relation between system and environment is continuously recreated through self- and external reference. Luhmann's theory is innovative because it attributes a central role to the environment rather than regarding it as secondary to the individual.

¹⁶⁰ Goldstein (1995), p. 84.

¹⁶¹ Ibid.

¹⁶² Goldstein (1995), p. 85.

¹⁶³ Deleuze & Guattari (1999), p. 51.

PART III

3.1 The 'environment' in Luhmann's social theory

3.1.1 *Autopoiesis and 'environment'*

Although the main protagonist of Luhmann's theory seems to be the system, I argue that what makes his theory innovative is his particular use of the notion of 'environment'. Luhmann's systems theory draws on the idea of autopoiesis as developed by Maturana and Varela. In their original theory of autopoiesis, represented as the particular organization of living systems,¹⁶⁴ no particular role is attributed to the environment with regard to the process of autopoiesis itself. The environment is represented as the 'domain of observation' to which such notions as purpose and teleology are attributed.¹⁶⁵ Similarly to Kant (see Chapter 2), purpose is not attributed to the autopoietic process itself but merely regarded as part of the discourse and description of such a process.

The environment does not represent physical space. Space plays a significant role in autopoietic theory because 'without unity in some space an autopoietic system is not different from the background in which it is supposed to lie, and, hence, can only be a system in the space of our description where its unity is conceptually stipulated'.¹⁶⁶ However, both the environment as domain of the observer and as physical space remain excluded from the process of autopoiesis itself - even if they make the description and emergence of an autopoietic system possible.

Maturana and Varela, contrary to Bernard and Luhmann, do not believe that the system requires a representation of the environment within itself:

[T]o talk about a representation of the ambience, or the environment, in the organization of a living system may be metaphorically useful, but it is inadequate and misleading to reveal the organization of an autopoietic system.¹⁶⁷

¹⁶⁴ Maturana & Varela (1980), pp. 76 and 78-79.

¹⁶⁵ Ibid., p. 78.

¹⁶⁶ Ibid., p. 94.

¹⁶⁷ Ibid., p. 99.

This is because an autopoietic system is precisely defined by the way in which it relies on its own operations. Maturana and Varela 'distinguish[] two structures that are going to be considered operationally independent of each other: living being and environment'.¹⁶⁸ The relation between system and environment is represented as one in which there are no 'instructive interactions'.¹⁶⁹

It can be argued that the environment came to represent the 'blind spot' of autopoietic theory. Maturana and Varela's idea of the 'blind spot' represents the epistemological problem that '*we do not see that we do not see*';¹⁷⁰ or, as Luhmann would say, an observer cannot observe himself observing. The 'blind spot' is explained through an optical experiment but is meant to make an epistemological argument, namely, it challenges the separation of understanding and experience that Kant proposed.¹⁷¹

Luhmann specifically incorporates the idea of the environment as 'blind spot' into his systems theory by referring to it as 'unmarked space'.¹⁷² Like Maturana and Varela, Luhmann distinguishes between the autopoietic system and the environment. However, whereas the former represent the environment as a descriptive domain that is separate from the autopoietic process itself, Luhmann attributes a central role to the environment in the process of autopoiesis.

3.1.2 Traditional characteristics of 'milieu'

Although the notion of environment is obviously present in Luhmann's work, its character and function are often misunderstood. The environment is not a thing in the world, an actual geographical space, or a relation (between it and a system). The distinction between system and environment, which represents the absolute premise of

¹⁶⁸ Maturana & Varela (1992), p. 95.

¹⁶⁹ Ibid., p. 101.

¹⁷⁰ Ibid., p. 19.

¹⁷¹ Ibid., p. 23: 'These experiences ... show how our experience is moored to our structure in a binding way. We do not see the "space" of the world; we live our field of vision. We do not see the "colors" of the world; we live our chromatic space. Doubtless ... we are experiencing a world. But when we examine more closely how we get to know this world, we invariably find that we cannot separate our history of actions - biological and social - from how this world appears to us'.

¹⁷² Luhmann (1998), p. 27; see Hayles (1999), p. 10 refers to the 'second wave of cybernetics' that incorporated reflexivity by attributing a more prominent role to the observer.

Luhmann's theory,¹⁷³ does not represent a relationship between two terms. Rather, the environment represents the *difference* between it and the system or that by virtue of which such a difference may come about. The distinction that Luhmann maintains between a relation and a difference is that the former represents an ontological view of the world whereas the latter supposedly avoids or subverts it.¹⁷⁴ What is crucial here, is that a difference is not an absolute either/or but that it is relative to the system and each time created anew. Luhmann does not focus so much on the idea of difference as such, but on the process of differentiation.

It is interesting to note that he draws on Darwin and evolution in order to elaborate his notions of environment and differentiation. It has been argued that Luhmann intentionally represents Darwin's description of environment as strictly deterministic, in order to contrast it with his own representation of environment.¹⁷⁵ Luhmann also observes:

[I]f systems theory is formulated in radical fashion as a theory of the production and reproduction of a difference between system and environment, then it makes little sense to retain this division into internal (variation) and external (selection) factors.¹⁷⁶

This is why he adds a third term to Darwin's notions of variation and selection, namely 'restabilization', which reinforces the idea of the system as an autonomous process.¹⁷⁷ Despite the apparent differences between Darwin's and Luhmann's representation of environment, it has been suggested that Luhmann's process of differentiation - which gives rise to both system and environment - can be regarded as a kind of evolution of systems. This would reveal a problematic aspect of Luhmann's theory because the particular temporality of systems seems irreconcilable with the idea of 'becoming' that characterizes evolution.¹⁷⁸

In developing his particular idea of environment, Luhmann makes productive use of certain characteristics that have traditionally been associated with the milieu. Its original ambiguity is explored through the simultaneous reliance on the idea of environment as surroundings with reference to a centre and environment as medium. The former is

¹⁷³ Luhmann (1998), p. 33: 'The theory proceeds by assuming the distinction between system and environment.'

¹⁷⁴ Badiou (1998).

¹⁷⁵ Winthrop-Young (2003), pp. 333-334.

¹⁷⁶ Ibid., pp. 336-337.

¹⁷⁷ Ibid., p. 331.

¹⁷⁸ Ibid., pp. 313-314.

represented in the system's distinction between outside and inside and in the asymmetry between system and environment itself. The latter is represented in the idea that environment enables differentiation, thereby negating the idea of privileged centres.

The contingency of the inside/outside distinction was previously emphasized by Bernard through his notion of the internal milieu (see para. 2.2.1 above). Luhmann, similarly, describes how the distinction between system and environment is drawn within the system itself. He describes how the system has no direct access to the external world and how the 'internal environment' represents an 'already-domesticated, already-pacified environment'.¹⁷⁹ As with Bernard, the reference to an 'internal environment' does not mean that Luhmann denies the existence of a physical environment.¹⁸⁰

Similarly to von Uexküll's notion of *Umwelt*, Luhmann represents the environment as being constructed by a system. Luhmann's environment can be regarded as an 'associated milieu' because each environment is relative to a system. He also describes the behaviour of systems in terms of 'orientation and expectations' rather than reflexes to an existing external environment.¹⁸¹ Goldstein's identification of the question of the direction of action, whether it should be attributed to organism or environment, is only apparently resolved by Luhmann through the idea that the system is constitutive of itself. This is, after all, only the case because it relies on the difference between it and its environment. Action is, therefore, in the end not attributed to either system or environment but is represented through the process of differentiation itself.

There is a necessary asymmetry between system and environment because of a 'difference in degree of relative complexity'.¹⁸² The environment appears to the system as differentiated into a multiplicity of system/environment relations. The system must maintain itself against this 'overwhelming complexity' of its environment; it does so by regarding the environment as resource or as information.¹⁸³ The asymmetry between

¹⁷⁹ Luhmann (1996), pp. 188-189.

¹⁸⁰ Ibid., p. 178: 'The difference between system and environment practised by a system presupposes and overlies a continuous reality. Thus the magnetic field of the earth is significant for organisms and their environment, even if, as a magnetic field, it "takes no heed" of the boundary between organism and environment.'

¹⁸¹ Ibid., p. 110.

¹⁸² Ibid., p. 182.

¹⁸³ Ibid., pp. 182 and 184: 'The difference in relative degree of complexity [between system and environment] is thereby grasped and thematized within the system primarily as the contingency of its

system and environment is evidenced by the fact that the system has a potential for operation and generation that the environment lacks. In Luhmann's words: 'The environment is only a negative correlate of the system. It is not a unity capable of operations; it cannot perceive, have dealings with, or influence the system.'¹⁸⁴ This means that the environment 'fails to be elevated to a corresponding plenitude of power'.¹⁸⁵

Any reference to power seems to be, at first sight, slightly out of place with regard to a theory that does not seem particularly interested in power relations. However, it has been noted how the difference between environment and system that Luhmann introduces leads to a change in the interpretation of power. The introduction of environment apparently leads to a 'bipolar' situation with two actors: system and environment.¹⁸⁶ Traditional representations of power rely on precisely this bipolar situation. However, in Luhmann's theory bipolar conflict between system and environment is lacking because they are in a continuous relation of mutual dependence. The environment does not dominate or determine the system, nor the other way around. According to Schütz, the introduction of the notion of environment - and the continuous differentiation between system and environment - renders the 'whole agonistic account of power, resistance and overcoming, etc.' irrelevant.¹⁸⁷

Although the environment in Luhmann's systems theory often seems to represent a passive space of expression or manifestation of the system - or a space from which a system differentiates itself - he emphasizes that

[t]he concept of the environment should not be misunderstood as a kind of residual category. Instead, relationship to the environment is constitutive in system formation. It does not have merely 'accidental' significance, in comparison with the 'essence' of the system. Nor is the environment significant only for 'preserving' the system, for supplying energy and information. For the theory of self-referential systems, the environment is, rather, a presupposition for the system's identity, because identity is possible only by difference.'¹⁸⁸

environmental relations. This thematization can assume two forms, depending on how the environment is viewed. If the environment is interpreted as a *resource*, then the system experiences contingency as *dependency*. If it is interpreted as *information*, then the system experiences contingency as *uncertainty*.'

¹⁸⁴ Ibid., p. 181.

¹⁸⁵ Schütz (1997), p. 261.

¹⁸⁶ Ibid., pp. 258-259.

¹⁸⁷ Ibid.

¹⁸⁸ Luhmann (1996), pp. 176-177.

The environment is described as a presupposition or as a condition of possibility for the system's unity. It is strange that, although the environment is constitutive of the identity of the system, it appears to lack an identity of its own.¹⁸⁹

3.2 The central role of 'environment'

3.2.1 *Consequences of 'environment' as centre*

Since Luhmann called his theory 'systems theory', thereby immediately privileging one side of the system/environment distinction, the central role fulfilled by the environment is easily overlooked. Although the system itself is only the difference between it and its environment, it remains the case that the system is explained with reference to environment rather than the other way around. Luhmann observes: 'all this does not mean, however, that the environment is merely a built-in opposition, pure appearance. Instead, one must distinguish "the environment" from systems within the environment'.¹⁹⁰ In other words, the environment has as much reality as a system itself has. Ultimately, however, the notion is left largely unexplained.

The lack of an appropriate account of environment becomes inexplicable when Luhmann recognizes that it in fact constitutes the non-foundational fundament of his theory.

[T]he environment, not 'the subject', 'underlies' social systems, and 'underlies' means only that there are preconditions for the differentiation of social systems (e.g., persons as bearers of consciousness) that are not differentiated with the system.¹⁹¹

A precondition is easily assumed as a necessary assumption that does not require further elaboration. However, the use of environment as fundamental presupposition has significant consequences. First, the use of the notion of environment destabilizes the role of the individual as privileged centre.¹⁹² Second, the notion of environment explains and allows for the introduction of differentiation, communication, and contingency.

¹⁸⁹ Schütz (1997), p. 261.

¹⁹⁰ Luhmann (1996), p. 181.

¹⁹¹ Ibid., p. 178.

¹⁹² Schütz (1997), p. 263, refers to environment as the 'constitutive imperfection' of systems which affects the traditional idea of systems as 'autonomous entities that control their conditions'.

With regard to the first consequence, the revolutionary impact of attributing a central role to the environment is revealed by Luhmann in a footnote where he refers to Canguilhem's work on the 'milieu' (the same footnote referred to at the beginning of this Chapter):

[T]he ontology of substance and essences therefore has no concept of environment at all. The eighteenth century began to rethink this in reflections on the significance of 'milieus' for the specification of genuinely indeterminate forms (e.g., human beings). The change can be seen in the concept of 'milieu' (which originally meant 'middle').¹⁹³

Luhmann observes elsewhere with regard to the difference between system and environment:

[T]his abandons, but does not simply dismiss, the traditional constitution of the world around a 'center' or a 'subject'. The center is replaced by the pivot of difference, or, more precisely, of system/environment differences that are differentiated in the world and that thereby constitute the world. Every difference becomes the center of the world.¹⁹⁴

Systems theory and the notion of autopoiesis that it relies on concerns a process of differentiation and (self-)generation. In other words, there is no longer a reliance on ontological entities.¹⁹⁵ According to Luhmann, the idea of the system is 'more suitable [than the subject] to the centerless world picture of contemporary science.'¹⁹⁶ As Canguilhem observed, the interpretation of 'milieu' as medium has been employed by the physical sciences to dissolve all centres of reference thereby negating the biological specificity of the individual form (see para 2.1.3 above).

The motive behind Luhmann's use of the notion of environment is clear from the citations above: he seeks to move from an ontological view of the world to a focus on processes of differentiation. However, it can be asked whether his use of the notion of environment is counterproductive. In other words, does the system not come to represent a centre? Luhmann would say that the system represents a difference, not a centre. Nevertheless, because of the emphasis on the system rather than on the environment, the environment can easily be mistaken for the mere condition of possibility for the emergence of the system. In this case, the environment is again

¹⁹³ Luhmann (1996), p. 537 (Ch. 5, n. 2).

¹⁹⁴ Ibid., p. 208.

¹⁹⁵ Pottage (1998b), p. 2: Luhmann performs a 'theoretical shift from "substance" to "emergence".'

¹⁹⁶ Luhmann (1996), p. 439.

relegated to the role it plays in many traditional theories that take the individual as centre of reference.

The second consequence of regarding environment as a fundamental presupposition is that it enables differentiation, communication, and contingency. Just as the action between particles in Newton's time could not be explained by reference to individual particles themselves, so systems cannot account for their own autopoietic reproduction. The environment makes autopoietic reproduction, or what Luhmann calls 'action out of action' or 'a "subject-free" concept of action', possible.¹⁹⁷ He tries to get around the traditional focus on the intentional actions and interactions of subjects by introducing the idea of a continuous process of differentiation. The interaction between system and environment is described by Luhmann in a similar way to von Uexküll's representation of the communication between signals and perceptual organs, namely as ad hoc, blind, and reliant upon a reduction of complexity tailored to the specific needs of a system.

3.2.2 *Maintenance of purposeful obscurity*

What makes Luhmann's theory innovative is not his idea of autopoietic systems, but the central role attributed to the environment.¹⁹⁸ However, he does not elaborate much on the importance and specifics of the environment. It has been suggested that his systems theory demonstrates an 'inability to grasp the significance of the context of distinctions'.¹⁹⁹ The question that must be addressed is: why does Luhmann fail to attribute more attention to what makes his theory innovative? The observations he made in a footnote, cited above, demonstrate that he was fully aware of the revolutionary consequences of the use of environment as a fundamental presupposition. After all, Luhmann uses the environment precisely *because* of this revolutionary potential.

There are several reasons that can be given for this lack of consideration. Perhaps Luhmann regarded the environment primarily as the condition of possibility for the emergence of the system. In other words, although his social theory is 'subject-less', the focus on the system betrays a reliance on an individual centre of reference. It could also be argued, as Canguilhem observed with reference to Goldstein's criticism of von

¹⁹⁷ Ibid., pp. 110 and 118.

¹⁹⁸ Schütz (1997), p.261; Schulte (1993), p. 24.

¹⁹⁹ Kjaer (2006), p. 74.

Uexküll, that 'in order for knowledge to remain possible, it is necessary that from this totality organism-environment emerges an unconventional centre from which a range of relations may be investigated'.²⁰⁰ This leads to a necessity to focus on a centre of reference in the form of the system, even if that centre is conceived of as a difference. Another reason why Luhmann does not explore the environment further could be that it represents the intellectual 'context' of his theory, as suggested by Kjaer. In this case, 'environment' can be read as representing the intellectual heritage of German Idealism from which Luhmann seeks to distance himself while - at the same time - remaining firmly indebted to it.²⁰¹ This represents him as struggling to give the environment a place within his theory, metaphorically speaking.

If Luhmann was aware of the significance of the notion of 'environment' and chose not to question or clarify it, then such lack of clarification must be intentional. Indeed, he observes: 'one is today disquieted by the futility of attempts to achieve clarity on the relationship between social systems and the environment'.²⁰² He seems to maintain a purposeful obscurity surrounding the notion of environment. In order to understand what benefit is gained by such obscurity, it must be recognized that obscurity lies at the heart of Luhmann's social theory.

By this is not meant that the theory itself is obscure, although it is at times certainly rather inaccessible, but rather that obscurity as a notion is central to his ideas on 'society' (or lack thereof). In his acceptance speech '*Abklärung der Aufklärung*' - a play on the literal meaning of Enlightenment - for the professorship he was offered in 1967, Luhmann argued that maintenance of obscurity is not only inevitable but often more productive and even more rational than pursuing Enlightenment.²⁰³

Maintenance of obscurity is, furthermore, inevitable because the only way in which something can be enlightened is by creating another 'unmarked space' somewhere else: 'every observation causes one side of a distinction to be designated and, consequently, for the other side to remain unmarked'.²⁰⁴ Obscurity is productive, and '*transparency is*

²⁰⁰ Canguilhem (2003), p. 184, n. 1 (my translation).

²⁰¹ Kjaer (2006), pp. 71 and 74.

²⁰² Luhmann (1998), p. 81.

²⁰³ Schulte (1993), pp. 9-10; see Luhmann (1998), p. 78, on the 'ecology of ignorance' as 'ecology of knowing'; and McGoey (2007), pp. 220-221, on Luhmann's and Nietzsche's emphasis of the unconscious and 'will to ignorance' in contrast with a 'will to truth' and 'will to power'.

²⁰⁴ Luhmann (1998), p. 79.

unproductive',²⁰⁵ because it is precisely *intransparency* that lies at the basis of social order. Luhmann observes: 'society develops figures of thought with which it can endure the unobservability of the world and allow intransparency to become'.²⁰⁶ The environment can be regarded as such a figure of thought.

His argument for intransparency grounds Luhmann's criticism of traditional social theories that presuppose a value consensus or shared symbolic system as the foundation of social order.²⁰⁷ He employs intransparency to propose his alternative social theory:

[T]he maintenance of social order [can be based] neither on nature nor on norms or values that are valid *a priori*. What is there to take their place? Since the seventeenth century, it has been believed the basis of order must lie in what is concealed and unknowable. Latency is a necessary requirement of order.²⁰⁸

Rather than a value consensus, it is intransparency - and the figure of thought that allows such intransparency to be thought: the 'environment' - that lies at the basis of social order.

Obscurity is a necessary correlate of knowledge, or rather is itself a form of knowledge, but it also fulfills another function in Luhmann's systems theory. As Schulte suggests, the introduction of the notion of 'unmarked space' or environment prevents a situation where systems 'oscillate helplessly' or do not emerge at all by mere tautology and paradox.²⁰⁹ Obscurity, in the form of the 'blind spot', is necessary for systems theory to function because it allows for the stifling effect of the foundational paradox of the self-reproducing system to be neutralized.²¹⁰ It can also be argued that the maintenance of ignorance regarding the concept of environment contributes to its role as a fundamental presupposition. In other words, its move to the background (its latency) enables it to fulfill its important role of making differentiation possible.

Nevertheless, some negative consequences can be identified of the lack of clarification of the notion of environment. First, such lack of clarification makes systems theory vulnerable to criticism. The environment, employed as metaphor, comes to stand for the defects or latent anxieties of the theory itself. Second, lack of recognition of the central

²⁰⁵ Ibid., p. 108.

²⁰⁶ Ibid., p. 112.

²⁰⁷ Luhmann (1996), p. 123: Luhmann refers to Weber and Durkheim.

²⁰⁸ Ibid.

²⁰⁹ Schulte (1993), p. 24.

²¹⁰ Ibid., pp. 24-25.

role of environment causes systems theory to 'turn in on itself'. To some extent this is inevitable for a theory that focuses on autopoietic systems. However, one can wonder whether it is desirable. Inevitably, it means that systems are turned into privileged centres - at least with regard to the environment. The latter is then once again regarded as mere condition of possibility. Third, the purposeful obscuring of the revolutionary potential of the concept of environment in a theory which exploits that potential to the full deprives this theory of its critical potential. As Schütz observes, Luhmann's maintenance of obscurity regarding the environment leaves that notion

in constant danger of retreating back into invisibility and of lapsing back into its habitual dwelling place of unsolved (unproblematized) complexity: the onto-epistemological trap ... that swallows and holds captured those phenomena which are too general and too present to be perceived.'²¹¹

PART IV

4.1 The 'environment' and modern rationality

4.1.1 *'Environment' and the state of man*

Canguilhem, contrary to Luhmann, singles the environment out for discussion. His identification of 'milieu' as a category of contemporary thought should not be understood as a methodological manoeuvre that allows Canguilhem to merely 'trace' the concept of environment. Rather, he suggests that the emergence and articulation of this concept can be associated with a particular rationality. This idea was later repeated by Luhmann in his statement cited at the beginning of this chapter.

Canguilhem links the emergence of the modern notion of environment to a shift in world views. He describes how, in ancient Greece, the cosmos was regarded as an integrated whole with man at its centre. It represented the 'habitat of man that was centred on man and seemed to be made for him exclusively'.²¹² The Copernican revolution changed this world view and led to the idea of a universe where 'the centre is

²¹¹ Schütz (1997), p. 275.

²¹² Canguilhem (2002), p. 33.

everywhere and the periphery nowhere'.²¹³ Man was no longer situated at the centre of the world. The state of man that emerges from this disintegration of the ancient world view is described by him as follows:

Man is no longer at the centre ('*au milieu*') of the world; *he is now 'un milieu' himself ... the milieu is the state in which nature has placed us; we roam a vast milieu; man is proportionate with different elements of the world, he is related to everything he knows.*²¹⁴

As discussed in Chapter 2, Kant elaborated his theory of understanding in the image of the Copernican revolution in physics. Man, as a subject of knowledge, no longer represents the centre of the cosmos but the centre of his own understanding. Kant introduces a distinction between the subject's understanding and the world of experience. For Canguilhem, the Copernican revolution implies that man is only one 'milieu' among many. He does not mean to say that man is a subject among subjects; rather that there is no definitive distinction between man and world.

Canguilhem, contrary to Kant, does not focus on the question of 'being' or 'subject' but on the idea of a '*milieu de vie*'.²¹⁵ His contemporaries, many of whom were existentialists - such as Sartre (see Chapter 1), could only conceive of the '*milieu de vie*' by regarding it as a 'situation' in relation to a subject. It has been suggested that Canguilhem's essay '*Le vivant et son milieu*' represents a critique of the 'naïve geographical philosophy' that many of his colleagues seemed to espouse.²¹⁶

His identification of 'milieu' as a 'category of contemporary thought' indicates the shift from a rationality that reasons from a privileged centre of reference, where the environment represents the unquestioned external surroundings of that centre, to a rationality where no privileged centre can be identified and the environment is regarded as enabling 'subject-free' action. Luhmann's use of the notion of 'environment' enables him to shift from an ontological world view with a focus on singular entities to a different rationality that relies on differentiation and the idea of 'action out of action'.

²¹³ Ibid.

²¹⁴ Canguilhem (2003), p. 193 (my translation).

²¹⁵ Piquemal (1985), p. 68.

²¹⁶ Ibid., p. 69.

Bourdieu gives an insight into the force of 'milieu' as a concept or category and its potential to question modern rationality while discussing his own notions of 'field' and 'habitus'. He describes how

the notion of habitus expresses first and foremost the rejection of a whole series of alternatives into which social science (and more generally, all of anthropological theory) has locked itself, that of consciousness (or of subject) and of the unconscious, that of Finalism and of Mechanicalism, etc..²¹⁷

He goes on to say:

[A]t the time the notion of habitus allowed me to break away from the structuralist paradigm without falling back into the old philosophy of the subject or of consciousness ... I wished to react against structuralism and its odd philosophy of action ... I wished to put forward the 'creative', active, and inventive capacities of habitus and of agent (which the word usually does not convey) but to do so by recalling that this generative power is not one of a universal mind, nature or of human reason.²¹⁸

Bourdieu notes how many theorists subsequently used similar notions in order to get away from the focus on the subject and consciousness as the ultimate terms of explanation in social theory.²¹⁹

4.1.2 *A biological concept of environment*

So how can a biological concept of environment be imagined? Canguilhem's observation that 'milieu' can only be understood in the life sciences as a fact to be constituted ('*fait à constituer*')²²⁰ indicates not only that the biological concept of environment has yet to be formulated, but also that the biological milieu itself must be understood as continuously developing. This is because it does not represent, as the traditional notion of environment does, a combination of physical laws. Rather, the biological milieu is made up of events. Canguilhem observes:

[B]ut isn't the cosmic environment, the animal environment in general a system of mechanical, physical and chemical constants, made of invariants ? Certainly this environment, which science defines, is made of laws but these laws are theoretical abstractions. The living creature does not live among laws but among creatures and events which vary these laws ... Because the qualified living being lives in a world of qualified objects, he lives in a world of possible accidents.

²¹⁷ Bourdieu (1985), pp.12-13.

²¹⁸ Ibid.

²¹⁹ Ibid., p. 14.

²²⁰ Canguilhem (1978), p. 177; Canguilhem (2006), p. 214.

Nothing happens by chance, everything happens in the form of events. Here is how the environment is inconstant. Its inconstancy is simply its becoming, its history.²²¹

How can this biological concept of environment, which no longer refers to a privileged centre of reference, be made to fit within ‘a philosophy of nature that is shaped by reference to the problem of individuality’?²²² Canguilhem observes that milieu as ‘category of contemporary thought’ does not render individuality irrelevant in the life sciences. If anything, the focus on environment only sharpens the need to discuss what the notion of the individual has come to signify in the contemporary life sciences. Canguilhem observes: ‘But we have ended up discovering that, in order for there to be an environment, there must be a centre.’²²³ In the next chapter, the changing role of the individual in the contemporary life sciences is discussed by reference to Canguilhem’s inquiry into - what he called - the ‘problem of individuality’.²²⁴

CONCLUSION

The notion of environment has proved to be a somewhat problematic concept; it is often not thought as a notion in itself but is usually regarded by reference to an individual. The environment emerged as a notion in physics and is most often interpreted as a resource, as external conditions of life, or as a geographical space. Such interpretations, as well as the traditional relation between environment and individual, have come to be regarded as unsatisfactory. I have argued that, rather than dismissing the notion of environment altogether, it is more productive to probe it as a concept or - as Canguilhem called it – as a ‘category of contemporary thought’. Canguilhem, and subsequently Luhmann, associated the emergence of the notion of environment with modern rationality. The environment enabled the emergence of the individual or subject, but at the same time signalled the potential to dissolve privileged centres of reference.

Canguilhem pointed out that no biological concept of environment exists. In order to conceive of such a concept, he seemingly suggested a return to the original notion of ‘milieu’ in physics. He discussed the original ambiguity of Newton’s notion of aether as

²²¹ Canguilhem (1978), p. 116.

²²² Canguilhem (2003), p. 165.

²²³ Ibid., p. 122.

²²⁴ For example, *ibid.*, pp. 91, 94 and 165.

‘milieu’ or medium that made ‘action at a distance’ possible. I have further explored the richness of this notion of milieu through Bernard’s idea of the ‘*milieu intérieur*’ and von Uexküll’s notion of ‘*Umwelt*’. Newton, Bernard, and von Uexküll all associated the milieu with action or communication that could not be traced back to a subject. I have argued that Luhmann relies on the traditional characteristics of the milieu, notably its ambiguity and relativity, to elaborate his own notion of ‘environment’. The attribution of a central role to environment in systems theory contributes to the destabilizing of centres of reference through the introduction of differentiation and contingency.

Only now can the question be addressed that remained implicit in the introduction to Canguilhem’s essay on the ‘milieu’, namely, what effect does the notion of environment as ‘category of contemporary thought’ have on the notion of the individual in the life sciences? Although the individual has not exactly been replaced by the environment, the recognition of the significance of the concept of environment does raise the question of how the individual comes to be represented. This is addressed in the next Chapter.

4. THE INDIVIDUAL

PART I

1.1. Introduction

1.1.1 Individuality in the life sciences

In the last chapter, I explored the implications of Canguilhem's proposition that the milieu has come to constitute a 'category of contemporary thought'.¹ One implication is perhaps that the individual, which usually figures as the other term in the relationship individual - environment, has lost its privileged and central role. Similarly to Canguilhem, who described how the Copernican revolution and the associated shift in rationality gave rise to the idea of the individual as 'milieu' among 'milieux',² Atlan observes that 'one of the elements of the great rupture called the scientific revolution of the seventeenth century is a change in the model of reference or privileged object from which generalizations are made'.³

The common perception seems to be that the individual, usually understood as an ontological or self-contained entity, was finally 'exploded' in the latter half of the twentieth century through developments in technology and the introduction of the notion of information into the life sciences.⁴ Whereas individuality was previously associated with a distinct living being that could be identified by reference to its material unity, the individual came to be regarded as fragmented or as a kind of 'continuity of pattern' that could be abstracted from its material instantiation.⁵ Molecular biology gave rise to a multitude of 'new' biological processes that almost made the individual form, as previously understood,

¹ Canguilhem (2003), p. 165 (my translation).

² See Chapter 3, para. 4.1.1.

³ Atlan (1995), p. 266.

⁴ Greco (2005), p. 15; Lecourt (1998), pp. 218 and 223: 'Information, with its discrete structure, replaces the signifying totality of form.'

⁵ Kay (2000), pp. 88-89, citing Wiener: 'The earlier accounts of individuality were associated with some sort of identity of matter, whether of the material substance of the animal or the spiritual substance of the human soul. We are forced nowadays to recognize individuality as something which has to do with continuity of pattern, and consequently with something that shares the nature of communication'.

disappear.⁶ Meanwhile, the individual as a concept was often regarded as either too capacious or too unrefined to adequately grasp the subtlety and the variety of processes and entities that formed the objects of inquiry of contemporary biology.

Rose believes that what is at issue is a transformation of 'the living being itself'⁷:

For a long time, our 'enlightened' image of the body consisted in an apparent 'recognition' of its systematic, bounded and self-regulatory character. Canguilhem and Foucault have both helped us understand the conditions -conceptual, institutional, technical - under which this organic image of the body was formulated. The visualization of the body on the dissection table, at least to a vitalist clinical gaze, revealed its wholeness as a living system, and as each layer was stripped away it appeared to reveal, at another level, the coherence of systems within systems.⁸

He argues that technological developments, and the change of scale they make possible, lead to 'new formulations of the problem of life'⁹ and observes:

[W]hat seemed unitary at one scale of magnifications is fragmented by electron microscopes, CT scans, PET scans, MRI ... The hierarchical, localized, organic unity of the body-organism is fractured, fragmented. Heterogeneity seems to rule rather than order and harmony.¹⁰

I argue that the alleged disappearance of the traditional individual form in the contemporary life sciences has led to the absence of a theory about individuality. The social sciences now inquire, in relation to the life sciences, into the transformation of subjectivities and the increased capitalization of fragmented biological entities.¹¹ However, the ways in which the concept of the individual - which arguably underlies such changing notions of subjectivity and fragmentation - itself has transformed is usually left unexplored. Similarly, in the life sciences gene centrism has given way to a focus on systems, networks, and pathways with sometimes little consideration for the ways in which such forms perpetuate or transform the notion of individuality in the life sciences.

⁶ See, e.g., Atlan (1995), p. 266. This alleged disappearance raises difficulties in instances where some sort of identification is relied upon. See, e.g., on the identification of the legal and biological person: Iacub (2002) and Pottage (2002).

⁷ N. Rose (1998), p. 162.

⁸ Ibid., p. 161.

⁹ Ibid., p. 162.

¹⁰ Ibid.

¹¹ With regard to the latter, the focus is on the shift from production - which characterized the rise of industrialization and the early critiques of capitalism - to reproduction as that which enables the exploitation of the self-generative potential of living processes. See, e.g., Franklin & Lock (2003), pp. 8-11.

However, perhaps paradoxically, the preoccupation with processes of individuation persists.¹² While different manifestations of individuality have become subject to negotiation and contestation, individuality as such represents a recurring question. For example, the life and social sciences continuously seek to account for processes of 'emergence', 'ontogeny', or 'autopoiesis' and the proliferation of individual forms that such processes give rise to.¹³ Although Luhmann, for example, seeks to eliminate the individual - as previously understood - as the main social category, his theory is concerned with the emergence of a unity that only 'exists' by virtue of processes of differentiation and self-reference.¹⁴ I argue that such 'narratives of individuation'¹⁵ can be regarded as manifestations of a need to theorize what 'individuality' has come to signify or encompass in the contemporary life and social sciences.

It is often assumed that the emergence of a 'multiplicity of individuals where once there was just the human organism and its constituent parts and functions'¹⁶ is distinctive of the contemporary life sciences. However, this emergence of individuals - or different 'degrees of individuality'¹⁷ - facilitated by technologies that make the isolation, identification, and visualization of such individuals possible, is not necessarily characteristic of the twentieth century. One only needs to think of the role played by the microscope in the conceptualization of the cell as the privileged individual form in the eighteenth century.¹⁸

Rose argues that the work of Foucault and Canguilhem has only limited relevance for the contemporary life sciences because both rely on an 'organic' image of life that has become obsolete. I argue, to the contrary, that Canguilhem's discussion of the 'problem of individuality'¹⁹ - which he addressed through the history of the concept of the cell - has great significance for the contemporary life and social sciences. It is not enough to assume the irrelevance of the traditional notion of the individual. Rather, the question becomes: how does individuality remain relevant and how has the notion of the individual been transformed? What is the meaning of individuality when the contemporary life and social

¹² Lewontin (1991), p. xiii: 'While physicists may have come to regard a human individual as a mere speck of jelly on a mole of dust circling a pinpoint of fire in a minor galaxy of a vast universe, the whole development of social theory in the last 300 years has been characterized by the progressive apotheosis of the individual as causally primary and as central to our concerns. Nor has scientific biology been formed differently.'

¹³ See, e.g., Emmeche (1997); Oyama (1985); Maturana & Varela (1980).

¹⁴ Luhmann (1996).

¹⁵ Pottage (2002), p. 284.

¹⁶ Ibid.

¹⁷ Canguilhem (2003), p. 77.

¹⁸ See Hacking (1983), pp. 186-209 on the role of the microscope in knowledge production.

¹⁹ Canguilhem (2003), p. 79.

sciences seem to reveal it as an ‘illusion’?²⁰ In Atlan’s words: ‘what becomes, then, of the “reality” status’ of the individual; and to what extent have we moved beyond it?’²¹

1.1.2 *The individual as ‘paradigm’*

The individual represents a common theme in Canguilhem’s essays. However, his most elaborate discussion of the individual can be found in an essay published in 1945 entitled ‘*La théorie cellulaire*’.²² This essay is often regarded as addressing the ontology of the individual, i.e. ‘what individuals consist of’²³ or what counts as an individual form.²⁴ However, I argue that Canguilhem’s discussion of what he calls the ‘problem of individuality’ is not limited to an inquiry into the ontological form of the individual or a description of different degrees of individuality. I believe that Canguilhem asks a different question; one that is similar to Atlan’s. He asks: ‘In the name of the cell, it is biological individuality that is in question. Is the individual a reality? An illusion? An ideal?’²⁵

No *one* science, not even biology, can answer this question. And whilst *all* the sciences can and must contribute to its elucidation, it is doubtful that the problem is truly scientific, in the usual sense of that word.²⁶

So what is Canguilhem doing in this essay? Is he strictly inquiring into the biological concept of the cell and its ontology? Is he merely discussing cell theory or is he, in fact, addressing a bigger philosophical question? Canguilhem provides the answer to such questions when he observes that ‘[t]he history of the concept of the cell cannot be separated from the history of the concept of the individual’.²⁷

In other words, to discuss the emergence and history of the concept of the cell means to explore the emergence, the various representations, underlying theories, imageries, and emotions that are associated with the notion of the individual. It is not so much the cell that

²⁰ Ibid., p. 99; Atlan (1995), p. 274.

²¹ Atlan (1995), p. 274.

²² Canguilhem (2003), pp. 53-101. This first appeared in ‘*Mélanges*’, a publication of the *Faculté des lettres* of the University of Strasbourg.

²³ Gayon (1998), p. 308

²⁴ Ibid., p. 317: Gayon notes that whereas most contemporary American philosophers would regard ‘genes, proteins, cells, organisms, populations’ and so on as ‘individuals’, Canguilhem only considers the cell, organism, and society as potential individual forms.

²⁵ Canguilhem (2003), p. 99.

²⁶ Ibid.

²⁷ Ibid, pp. 78 and 88, citing Prenant: ‘*It is the character of individuality that dominates the notion of the cell, it even suffices as its definition.*’ (My translation).

Canguilhem is concerned with. Rather, it is the category of the individual as it migrates and is exchanged between biology, philosophy, and anthropology and that often represents their preferred entity of analysis and centre of reference.

Canguilhem begins his inquiry by questioning the apparently most unquestionable of biological individuals, i.e. the cell. The cell provides the framework for his 'problematization'²⁸ of individuality; it is the cell or organism that allows for the unfolding - rather than the containment - of the individual. Canguilhem does not equate the various manifestations of individuality as they appear in different contexts and disciplines.²⁹ It is clear that different forms of individual require different methods of investigation. However, I argue precisely this: that Canguilhem does not primarily inquire into what an individual *is* in a particular discipline. Rather, he inquires into the concept of the individual or the 'problem of individuality'. In other words, the individual as it is replicated and rehearsed irrespective of its particular manifestations - even if he uses the biological individuality of the cell in order to perform this task. As Canguilhem observes in his essay on the history of the concept of the cell, '[i]t is the entire problem of the individual that is at issue here'.³⁰

How might this peculiar approach be explained? Without recognizing Canguilhem's influence on Foucault's methodology, Agamben discusses Foucault's use of what Agamben calls a 'paradigm'.³¹ Foucault used such signifiers as 'confession', 'asylum', 'state' and 'power' as paradigms that are abstracted from any particular use and that are only given specific meaning in a particular context. Agamben observes that Foucault may have described particular historical phenomena but that such phenomena are at the same time used to manifest and render intelligible a wider historical and problematic context.³²

In order to perform this double function, these phenomena represent singular manifestations that render their wider context visible and intelligible precisely through their singularity. Agamben explained this by reference to the notions of 'exemplar' and 'exemplum'. He argued that the Foucauldian paradigm performs both functions

²⁸ See Foucault (1992), p. 11, with regard to his own method: 'It was a matter of analyzing, not behaviors or ideas, nor societies and their "ideologies", but the *problematizations* through which being offers itself to be, necessarily, thought - and the *practices* on the basis of which these problematizations are formed.'

²⁹ Atlan (1995), p. 274: It would be a 'confusion' to 'identify ... the molecular and cellular self defined by an individual's immune system with the self of which we have subjective consciousness ... There is an irreducible difference between how we become aware of the two phenomena, even if, relying on analogy, we designate them by the same name'.

³⁰ Canguilhem (2003), p. 78 (my translation).

³¹ Agamben (2008), p. 18.

³² Ibid, pp. 18-19.

simultaneously; it serves as a model or manifestation and - more importantly - it gathers various practices and understandings into 'a new "*contexte problématique*"'.³³ Phenomena are abstracted from specific use, as Agamben says, 'not to be placed in another domain, but - on the contrary - to demonstrate the canon of its use which is impossible to present in any other way'.³⁴ I argue that the cell, in Canguilhem's essay, represents at the same time the exemplar - or manifestation - of biological individuality and the exemplum: the moral and intellectual questioning of the problematic of individuality itself.

1.1.3 *The 'problem of individuality'*

I argue that Canguilhem's main object of inquiry in his essay on the history of the concept of the cell is not the cell as biological or ontological entity. Rather, Canguilhem questions the way in which individuality represents the primary object of inquiry in the life sciences. The cell, therefore, performs a double function in his essay: it is the exemplar of the cell that makes reflection on the concept of the individual in the life sciences possible. Whereas the individual as object of inquiry is mostly assumed as an existing entity whose characteristics and functioning are to be explained and explored, Canguilhem explores the constant preoccupation of the life sciences with individuality - or with the individual form - as such.

He does not regard the individual as either the 'ultimate (indivisible) term that marks the end of the analysis'³⁵ or as the starting point of analysis. Rather, the individual is not presupposed at all; it is questioned. Such questioning is ultimately unavoidable because any 'philosophy of nature that is centred on the problem of individuality'³⁶ cannot proceed without interrogating the individual that represents its privileged centre of reference.

I argue that Canguilhem speaks of the 'problem' of individuality for a variety of reasons. First, the individual not only represents an object of inquiry but also, at the same time, an obstacle to it. In fact, Canguilhem believes that this is the case with any object of inquiry in the sciences.³⁷ The concept of the cell does not merely represent an existing unit, an analytical tool, or a mere simplification that allows further research into life's processes.

³³ Ibid., p. 20.

³⁴ Ibid., p. 19 (my translation).

³⁵ Lecourt (1998), p. 219.

³⁶ Canguilhem (1993), p. 165 (my translation).

³⁷ Ibid., p. 203: 'the obstacle to science and the object of science are one and the same' (my translation).

Rather, Canguilhem observes that: ‘the value of [cellular] theory lies as much in the obstacles that it has given rise to as in the solutions that it has provided’.³⁸

Second, regarding individuality as a ‘problem’ is a critical move methodologically. It indicates that individuality represents a question that gives rise to further questioning rather than a question that requires an answer. It also indicates a different approach to epistemology: Canguilhem inquires into specific philosophical problems rather than into theories.³⁹ Finally, I argue that the focus on individuality as such - and on a particular understanding of the individual as autonomous - represents something of a problem for Canguilhem in normative terms. Following his own belief that there is no such thing as an ‘innocent’ concept,⁴⁰ the individual as privileged centre of reference expresses a certain ideological commitment.⁴¹

PART II

2.1 The individual in Kant

2.1.1 *Identity, unity, autonomy*

In order to appreciate the originality of Canguilhem’s discussion on individuality, and the object of his critique, it is necessary to return to the history of the modern notion of the individual. The idea that informs both the life and social sciences is that there exists a ‘profound incommensurability between the objective, centerless physical world and the subjective, perspectival world of the self’.⁴² This incommensurability is often attributed to the particular rationalities of the physical and chemical sciences on the one hand, and the life and social sciences on the other. It concerns the consequences of the Copernican revolution in physics and the Copernican revolution in *metaphysics* that Kant sought to

³⁸ Ibid., p. 99.

³⁹ See Osborne (2003); Deleuze (2000), p. 211, n. 1: ‘One of the most original characteristics of modern epistemology is the recognition of this double irreducibility of the “problem” (in this sense, the use of the word problematic as a noun seems an indispensable neologism to me).’ (My translation). Deleuze refers to Canguilhem’s distinction between problem and theory in ‘*Le normal et le pathologique*’.

⁴⁰ Duroux (1993), p. 49.

⁴¹ Canguilhem (2003), p. 96, notes, with regard to ideas inspired by the ‘Marxist-Leninist dialectic’, that the history of biology ‘has indeed been written by the bourgeois’ (my translation); Lewontin (1991), p. xiii: ‘Nothing better characterizes bourgeois thought than its obsessive concentration on individuals.’; Greco (2005), p. 20.

⁴² Tauber (1994), pp. 203-204.

establish (see Chapter 2). In the former the milieu, rather than the ancient cosmos, comes to dominance while in the latter the individual becomes centre (even if it is the centre of his *own* universe rather than of the physical universe as such).

The centrality of the individual, divorced from its surroundings, was reinforced by Descartes' construction of the thinking and doubting 'I' as 'a separate entity'.⁴³ This reveals how the individual has historically been regarded first and foremost as a problem of - and for - knowledge. Kant consolidated the idea of the individual as a problem of understanding, as well as many characteristics that are traditionally associated with individuality. He elaborated the idea of the individuality of the subject as the 'transcendental unity of apperception'⁴⁴ and as the centre of reference of his theory of understanding. He also developed the corresponding idea of the identity or 'unity of diversity' of objects of experience.

Kant referred to the subject in his first *Critique* as the 'unity of consciousness which precedes all data of intuition, and without reference to which no representation of objects is possible. This pure, original, and unchangeable consciousness I shall call *transcendental apperception*.'⁴⁵ The individuality of the subject and the unity of the object of experience are intimately connected. The subject only emerges as the centre of reference of its own reason and experience when it unifies the diversity of the empirical world, thereby constituting the objects of its own reasoning and judgment.

The Kantian representation of the individuality of the subject and the identity and unity of the object gives rise to the three main characteristics that, arguably, still determine how individuality is thought: identity, unity, and self-consciousness. I draw here on the work of Tauber who wrote, more specifically, about the development of a notion of 'self' in immunology discourse.⁴⁶ However, these characteristics are also often associated with other kinds of individuals in the life and social sciences. The individual subject is identical because it is a 'transcendental supposition', i.e. it is a condition distinguished from the empirical world and is - therefore - not wholly subject to change.⁴⁷ The unity of the

⁴³ Ibid., p. 144.

⁴⁴ Ibid., p. 237.

⁴⁵ Ibid., citing Kant; see also Kant (2003), pp. 77-79.

⁴⁶ Ibid.

⁴⁷ Ibid., p. 237, citing Kant: 'The consciousness of oneself ... is ... empirical only, and always transient. There can be no fixed or permanent self in that stream of internal phenomena. What is necessarily to be represented as numerically identical with itself, cannot be thought as such by means of empirical data only. It

individual emerges as a consequence of the process of unification of diverse experience. The autonomy of the subject is constituted by, and reflected in, its self-consciousness. This self-consciousness, as opposed to the transcendental structure of the ‘unity of apperception’ itself, is empirical. It ‘refers to the capacity to reflect on its own unity and identity’.⁴⁸ I believe that Luhmann used this idea of autonomy or self-consciousness, i.e. the reflecting upon one’s own reflection or reasoning, in his idea of the ‘observer’ (see Chapter 3).⁴⁹

2.1.2 The ‘unity of diversity’ or ‘system’

Kant’s particular form of the ‘unity of diversity’ (see Chapter 2, para. 2.2.3) combines the aspects of identity, unity, and autonomy that determine most contemporary accounts of individuality. The form of the *unitas multiplex*⁵⁰ has, more recently, influenced understandings of individuality in both the life and social sciences. Kant believed - paradoxically - that it is only by regarding a living process as a *unity* of diversity that its contingency or diversity can be recognized. The organic individual as ‘unity of diversity’ is to be distinguished from the mechanistic individual that represents a mere material aggregate of parts. The notions of ‘system’ and ‘whole’ are intended to reflect this difference in complexity. However, such notions potentially give rise to the misunderstanding of diverse processes as clearly identifiable ontological entities.

Heidegger pointed out that the ‘unity of diversity’ or the ‘system’ is a figure of thought that is particular to a certain era and rationality that he characterized as ‘the age of the world picture’.⁵¹ According to Heidegger, whereas philosophy in the Middle Ages was characterized by a ‘ranked order of correspondences’,⁵²

what belongs properly to the essence of the picture is standing-together, system. By this is not meant the artificial and external simplifying and putting together of what is given, but the unity of structure in that which is represented [*im Vorgestellten*] as such, a unity that develops out of the projection of the objectivity of whatever is.⁵³

must be a condition which precedes all experience, and in fact renders it possible, for thus only could such a transcendental supposition acquire validity.’; See also Kant (2003), p. 81.

⁴⁸ Ibid.

⁴⁹ Luhmann (1998), p. 7.

⁵⁰ Luhmann (1996), p. 18.

⁵¹ Heidegger (1977), p. 141: ‘where the world becomes picture, the system, and not only in thinking, comes to dominance’; Ibid., pp. 129-130: Heidegger describes what is characteristic of ‘the age of the world picture’: ‘What is, in its entirety, is now taken in such a way that it first is in being and only is in being to the extent that it is set up by man, who represents and sets forth.’

⁵² Ibid., p. 141.

⁵³ Ibid.

The representation of a living process as a system makes it possible to turn that process into an object of knowledge and judgment. However, Heidegger noted that ‘where the system is in the ascendancy, the possibility always exists also of its degenerating into the superficiality of a system that has merely been fabricated and pieced together’.⁵⁴ The particularity of the ‘unity of the diverse’, then, goes unnoticed when the system is regarded as a mere material aggregate. Heidegger believed, probably because of this, that ‘the uniqueness of the systematic in Leibniz, Kant, Fichte, Hegel, and Schelling - a uniqueness that is inherently diverse - is still not grasped’.⁵⁵

Although its philosophical heritage is not always recognized, ‘systems-thinking’ has had a significant impact on contemporary biology. Jacob, for example, observes that ‘every object that biology studies is a system of systems’.⁵⁶ He argues: ‘whatever their level, the objects of analysis are always organizations, systems. Each of them is used as an ingredient by the one above. Even that old irreducible protagonist, the atom, has become a system.’⁵⁷ Jacob coins the word ‘*integron*’ in order to make further sense of this hierarchy or juxtaposition of different systems.⁵⁸

The idea of the system has recently been taken up by developmental biology where ‘*system*’ implies some degree of self-organization, in which ‘self’ is not some privileged constituent or prime mover, but rather an entity-and-its-world’.⁵⁹ This means that the idea of the system is now used to straddle the distinction between individual and environment. Theories of autopoiesis have also adopted the idea of the system in order to inquire into the particular organization and individuality of living processes (see para. 4.1.3 below).

⁵⁴ Ibid.

⁵⁵ Ibid.

⁵⁶ Jacob (1976), p. 307.

⁵⁷ Ibid., p. 323.

⁵⁸ Ibid, p. 302; Rheinberger (2000), pp. 234.

⁵⁹ Oyama, (2000), p. 119.

2.2 Kant's influence

2.2.1 *The individual as subject*

The association of individuality with identity, unity, and autonomy has been perpetuated by inquiries in the social sciences that focus on the life sciences. This is most apparent where the object of inquiry is the influence of the life sciences on the creation and transformation of subjectivities. Rose, for example, argues that the contemporary life sciences give rise to a particular form of 'subjectification';⁶⁰ not in the sense of 'subjection' but in the sense of 'the *creation* of subjects'.⁶¹ Drawing on Foucault's discussion of 'techniques of the self'⁶² (see para. 4.1.2 below) and - perhaps inadvertently - reconnecting this idea with its Kantian heritage, subjectification regards the different ways in which individuals 'relate to themselves' through a "somatic ethics" - ethics not in the sense of moral principles, but rather as the values for the conduct of a life - that accords a central place to corporeal, bodily existence'.⁶³

Such inquiries, therefore, focus on the transformation of the particular *forms* that subjectivities take. They do not consider the ways in which subjectivity or individuality itself is put into question by the contemporary life sciences. It is, for example, left unquestioned how this proposed 'relation to self' - which Foucault proposed - represents a particular form that implies a transformation of the traditional understanding of individuality (in relation to regimes of knowledge and power).⁶⁴ Rather, the identity, unity, and autonomy of emerging subjectivities is emphasized by reference to familiar notions such as 'responsibility' and 'freedom' that also dominated Kant's political agenda more than two centuries ago (see Chapter 2, para. 1.2.2).⁶⁵

For example, Rose and Novas propose that 'rather than seeing these practices of genetic subjectification in isolation, we suggest that they intersect with, and become allied to,

⁶⁰ N. Rose (2007), p. 6.

⁶¹ Ibid., p. 110.

⁶² Foucault (1992), p. 11.

⁶³ N. Rose (2007), p. 5.

⁶⁴ Ibid., p. 25: Rose himself observes: 'Social theorists have recently focused on historical transformations in the self, often analyzing these in terms of increasing individualization and reflexivity ... My focus is related but different.'

⁶⁵ Though these notions obviously have a different significance in different historical periods. Kant (1963), p. 3: Kant sought to release man from his 'self-incurred tutelage'; he wrote the first *Critique* so that man could use reason 'without direction from another'. Rose focuses on self-empowerment through information and communication.

contemporary norms of selfhood that stress autonomy, self-actualization, prudence, responsibility, and choice.⁶⁶ Rose suggests that what is distinctive about the ‘contemporary politics of life’ is a ‘complex of marketization, autonomization, and responsabilization’.⁶⁷ The main aspect that distinguishes these references to autonomy and responsibility from previous ones is perhaps the ‘centrality accorded to the soma, to the flesh, the organs, the tissues, the cells, the gene sequences’.⁶⁸ I argue that it is perhaps more interesting to discuss how the notion of the individual itself is being reconceptualized in the life and social sciences in ways that diverge from Kant’s emphasis on identity, unity, and autonomy.

2.2.2 *The identity and integrity of the organic ‘self’*

The identity and integrity of the ‘self’, which is often closely associated with Kant’s representation of the individuality of the subject, has been repeated in immunology discourse; the field of inquiry where the identification of the individual and the determination of its boundaries form the main object of inquiry. The problem of individuality is revealed when the distinction between biological ‘self’ and ‘non-self’ is of immediate and vital importance.⁶⁹

Immune discourse relies to a large extent on biological notions of organismic integrity and identity,⁷⁰ even if such notions are far from unambiguous themselves. The emergence and development of the biological notion of ‘self’ can be regarded as closely intertwined with the construction of ‘self’ in social and political theory:

Because bourgeois economic and social ideology, and by extension, biological theory as well, had placed the individual at the causal and analytic center, the chief ideological preoccupation of the 19th and 20th centuries has been the problems of the *self*. How does the individual know itself, ... how does it protect its privileged self-hood not only from the invasive attacks of other selves, but from the engulfing collective that threatens to consume and digest the self, assimilating it with other selves into an undifferentiated mass?⁷¹

The difference between previous and more recent conceptions of ‘self’ in immunology discourse is that the former represent the immune process as ‘an activity protecting

⁶⁶ Novas & Rose (2000), p. 502.

⁶⁷ N. Rose (2007), p. 4.

⁶⁸ Ibid., p. 105.

⁶⁹ Cf. Haraway (1991), p. 204.

⁷⁰ Chernyak & Tauber (1991), p. 109; Ibid., p. 111: the concepts of integrity and identity do not necessarily coincide in relation to the organism.

⁷¹ Lewontin (1991), p. xv.

organismic integrity', while the latter regard it as a process '*constituting* that integrity'.⁷² This indicates a shift from the traditional focus on the identity and autonomy of the biological individual to

an understanding of the indeterminateness of organismal integrity, maintained and perpetuated through an ongoing process of self-definition. The self could no longer be clearly delineated as a given entity. The 'boundaries' of the organism are constantly being reestablished under the assault of temporal change and environmental challenge.⁷³

Such a shift from the notion of the individual as an existing entity to its understanding as a process is discussed below with reference to the thought of Nietzsche and Canguilhem.

2.2.3 *The individuality of the 'gene'*

The traditional characteristics associated with individuality also came to determine the description of the 'gene'. Whereas the cell previously figured as the prototypical individual in biology, the gene arguably fulfilled that role from the beginning of the twentieth century. The comparison is often made between the gene as the dominant individual form in classical genetics and the atom in physics or the molecule in chemistry.⁷⁴

Jacob observes that as a 'product of reason, the gene seemed to be an entity with no body, no density, no substance'.⁷⁵ In other words, the gene did not only represent a substantial or ontological being but was perhaps primarily a manifestation of a particular form of reason. The individuality of the gene corresponded to the idea of the individual as active agent that became prominent through Kant's philosophy and the role of the subject in it. If this particular representation of the gene has been productive to the extent that it has provided popular and scientific discourse with a seemingly identifiable 'actor', the productivity of the concept is nowadays largely attributed to how it calls the traditional characteristics of individuality into question.

When it first emerged, the gene was regarded as a singular and substantial unity - although vaguely defined - to which all hereditary potential was ascribed. It was subsequently

⁷² Chernyak & Tauber (1991), p. 110.

⁷³ Tauber (1994), p. 230, with reference to Metchnikoff's thought in immunology.

⁷⁴ Rheinberger (2000), p. 220.

⁷⁵ Jacob (1976), p. 226.

represented by molecular biology as a ‘material entity’ and a ‘carrier of information’.⁷⁶ However, more recently the concept of the gene has been regarded as lacking a determinate referent. The ‘gene’, it is said, does not refer to a clearly identifiable entity or unity. Rather, it can be regarded as a ‘boundary object’ whose primary contribution is how it organizes and focuses research and makes the production of knowledge possible.⁷⁷

Whereas the gene was previously regarded as separate from the material environment in which its hereditary material was expressed, it gradually came to represent the difficulty itself of maintaining a distinction between individual and environment. The gene-centric view with its emphasis on identity, unity, and autonomy seems to have given way to an exploration of the seemingly impossible maintenance of the boundaries of the gene as individual form. This is accompanied by a shift in focus from the ontology of the gene to the many different processes that define it, such as ‘regulation, expression, and transcription’.⁷⁸

2.2.4 The individuality of the ‘system’

The emergence of systems biology represents another example of the negotiation of individuality in contemporary biology. Here, the focus is not so much on the individual understood as the singular entity or organism. Rather, the biological ‘system’ is taken as the theoretical tool through which an understanding of various processes is sought. The idea behind the emergence of systems biology is that traditional biology, by focusing on the specific functions of a singular entity or process, necessarily only ‘yield[s] relatively limited insights’.⁷⁹

The rise of systems biology can be regarded as a shift in theoretical focus, as much as a practical response to the enormous amounts of information that have been generated by genome mapping exercises. The information generated makes a more integrated approach both possible and desirable. The ‘system’ of systems biology can be regarded as a model that makes research into the many interactions, networks, and relationships between biological processes possible.

⁷⁶ Rheinberger (2000), p. 222 (reference to Sarkar).

⁷⁷ Ibid., p. 220.

⁷⁸ N. Rose (2007), p. 46.

⁷⁹ Institute for Systems Biology (2009): <http://www.systemsbiology.org> (Intro - Systems Biology: the 21st century science) (25 February 2009).

The question is whether this more integrative approach represents a new kind of holism, so that the 'system' can be understood as a new type of biological individual. It would then be regarded as either the material combination or the conceptual 'container' for a variety of entities and processes and would represent individuality on a different scale. However, the system does not replace - or disregard - the traditional individual. It should not be regarded as an alternative object of inquiry, as the name 'systems biology' seems to suggest.⁸⁰ Rather, it represents an

integrated and interacting network of genes, proteins and biochemical reactions which give rise to life. Instead of analyzing individual components or aspects of the organism, such as sugar metabolism or a cell nucleus, systems biologists focus on all the components and the interactions among them.⁸¹

Systems biology, therefore, represents a shift of focus from the entity as singular unity to a focus on networks and interrelated processes. However, such networks are still largely regarded as a way to represent interactions between existing individual entities.

2.2.5 *Networks and pathways*

A focus on the individual living form is often regarded as that which distinguishes biology from the physical and chemical sciences. Biology has, in fact, been defined as the 'investigation of the processes leading to the development of individuality in every respect'.⁸² Jacob observes that one of the main strategies of biology as a discipline is individualization: 'it tries to arrange the problems in series, to individualize the objects and formulate questions that can be answered by experiments.'⁸³ However, the emergence and identification of an individual has perhaps more to do with the requirements of research and experimentation than with the existence of a clearly delineated entity. As Goldstein said:

In our cognitive procedure we halt with the *individual* as a preliminary whole, simply because we here arrive factually at a relatively satisfactory result; at least, at a much better result than if we started in the customary manner from the parts.⁸⁴

⁸⁰ Henry (2003), citing Westerhoff: 'Systems biology is not the biology of systems.' Available at: <http://pubs.acs.org/cen/coverstory/8120/8120biology.html> (25 February 2009).

⁸¹ Institute for Systems Biology (2009) <http://www.systemsbiology.org> (Intro – Systems Biology: the 21st century science) (25 February 2009).

⁸² Lenoir (1982), p. 277.

⁸³ Jacob (1976), p. 305.

⁸⁴ Goldstein (1995), p. 393.

Despite the apparent significance that is often attributed to the individual, it often remains somewhat elusive as an object of inquiry. It has been said, for example, with regard to the individual organism:

[W]e then have the curious irony that although Darwinism is a theory of individual survival and reproduction, of individual adaptation, the organism as organism plays no role at all. There is no unique domain of forces that are seen at the level of the organism ... the critical role of the individual is threatened and contradicted by its placement at the boundary between autonomous internal and external forces. The contradiction is a very deep one, for if there is no boundary between the internal and the external, if they flow continuously into each other as the premodern natural philosophers thought, then how do we locate the individual at all?⁸⁵

In fact, the life sciences often focus on processes that extend or move *beyond* the individual form.⁸⁶ In relation to heredity, for example, 'the generation of organisms is regarded as a domain regulated by structures or forces extending beyond the momentous act of generating an individual being',⁸⁷ while the emphasis was - historically - on 'a fascinating lawfulness, a seemingly mathematical regularity by which forms come and go, appear and disappear'.⁸⁸ The focus on particular individuals and their 'organization' may, therefore, obscure the importance of a multitude of different processes.⁸⁹

What characterizes more recent inquiries is how the category of the individual is no longer called upon to conceptualize a single organism or process. Rather, the question is: how can heterogeneous processes be conceptualized?⁹⁰ In the contemporary life and social sciences, reference is made to networks, relationships, and pathways. The idea of a network is usually employed to signify the interaction or connection between various entities and processes.⁹¹ The notion of the network relies to a large extent on traditional understandings of individuality because it represents the interconnection between, or the enumeration of,

⁸⁵ Lewontin, (1991), p. xv.

⁸⁶ Goldstein (1995), p. 392: 'Many phenomena of the organism point beyond the individual'.

⁸⁷ Müller-Wille & Rheinberger (2007), p. 6.

⁸⁸ Parnes (2007), p. 322.

⁸⁹ Rheinberger (1997a), p. 20: 'Both Michel Foucault and François Jacob have identified "organization" as the key concept constitutive of the "new" science of biology ... But it seems pertinent for a full understanding of what constituted biology to recognize the interindividual and intraspecific dimensions that most of its concepts gained around 1800. Instead of referring, as in earlier times, to individual bodies, organic functions like generation, growth, development, nutrition, and sensation were increasingly perceived as reproductive functions physically constituting the unity of species.'

⁹⁰ Strathern (1996), p. 521, referring to Latour's idea of the network: 'The concept of network summons the tracery of heterogeneous elements.'

⁹¹ Ibid., p. 522: 'The network is an apt image for describing the way one can link or enumerate disparate entities without making assumptions about level of hierarchy. Points in a narrative can be of any material or form, and network seems a neutral phrase for interconnectedness.'

existing individual entities. As a notion, it does not necessarily question or transform the category of the individual as such.⁹²

A separate question is whether the network itself represents a new type of individual. In other words: 'what kind of unity characterizes networks?'.⁹³ It has been argued that 'associative action suggests a form of multiplicity that eludes the distinction between whole and part.'⁹⁴ The network is, then, likened to the form of the *unitas multiplex* or 'unity of diversity'. Regarded in such a way, it represents a kind of Kantian epistemological construct that enables us to grasp a variety of interconnected processes that would otherwise remain unintelligible. The problem with the identification and location of a network remains similar to that of any individual form. However, a network is potentially even more 'limitless' in the absence of - what seem to be - natural boundaries.⁹⁵

2.3 The individual in Nietzsche

2.3.1 *The process of 'self-overcoming'*

The difference between the notion of individuality most often associated with Kant and recent references to systems and networks in the contemporary life sciences, is that the former is characterized by reference to the characteristics of identity, unity, and autonomy and the latter signify various processes that may or may not give rise to the emergence of individual forms. The identifiable individual no longer seems to represent a presupposition or centre of reference, nor is it necessarily the point of departure or point of application of a normative or epistemological theory.

Tauber addresses how this shift from the association of the individual with an entity to its association with a process can be found in the work of Nietzsche. Nietzsche challenged Kant's representation of the individuality of the subject as the 'centrality of action and the activity of willing'.⁹⁶ He did this by elaborating the idea of an 'active self, and more

⁹² Pottage (2001), p. 132.

⁹³ Ibid., p. 130.

⁹⁴ Ibid.

⁹⁵ Strathern (1996), p. 523: 'However, the power of such analytical networks is also their problem: theoretically, they are without limit.'

⁹⁶ Tauber (1994), p. 232.

profoundly of the self striving for self-definition in a constant process of overcoming'.⁹⁷ Nietzsche's inspiration for this particular representation of the individual can be traced back to his early interest in the organism (see Chapter 6, para. 2.1.2) and his later elaboration of the process of living as a manifestation of a 'will to power'.⁹⁸

He observed: 'life itself confided this secret to me: "Behold", it said, "I am that which must always overcome itself"'.⁹⁹ Unlike Kant, Nietzsche did not assume the self as a transcendental condition or presupposition of knowledge or morality. Rather, it is represented as that which needs to be 'actualized in its struggle, in the self-definition of its world'.¹⁰⁰ Nietzsche described the organic individual as a dynamic and polemical activity that signified a constant overcoming, rather than a maintenance of identity or an effort of self-preservation:

Spinoza's law of 'self-preservation' ought really to put a stop to change: but this law is false, the opposite is true. It can be shown most clearly that every living thing does everything it can not to preserve itself but to become *more*.¹⁰¹

He continues:

Life, as the form of being most familiar to us, is specifically a will to the accumulation of force; all the processes of life depend on this: nothing wants to preserve itself, everything is to be added and accumulated.¹⁰²

The preservation of identity cannot, therefore, be regarded as the main characteristic of living processes:

Physiologists should think again before positing the 'instinct of preservation' as the cardinal drive in an organic creature. A living thing wants above all to *discharge* its force: 'preservation' is only a consequence of this – Beware of *superfluous* teleological principles! The entire concept 'instinct of preservation' is one of them.¹⁰³

Goldstein influenced Canguilhem's work and has been regarded as a possible 'link' between Canguilhem and Nietzsche.¹⁰⁴ He repeats Nietzsche almost literally when he observes that 'a drive towards self-preservation may appear as an essential trait of the organism, whereas, actually, the tendency towards self-preservation is a phenomenon of

⁹⁷ Ibid.

⁹⁸ Nietzsche (1968), p. 333.

⁹⁹ Nietzsche (1971), p. 124.

¹⁰⁰ Tauber (1994), p. 233.

¹⁰¹ Nietzsche (1968), p. 367.

¹⁰² Ibid., p. 368.

¹⁰³ Ibid., p. 344.

¹⁰⁴ Stiegler (2001), p. 101, n. 30, regards Goldstein as the 'bridge' between Nietzsche and Canguilhem

disease, of “decadence of life”¹⁰⁵. Rather, what defines living processes is what Nietzsche calls ‘will to power’ and what Canguilhem calls ‘vital *normativity*’ (‘*normativité vitale*’)¹⁰⁶ (see Chapter 6). Both notions imply the overcoming of self rather than self-preservation. However, self-overcoming and self-definition or self-description are not mutually exclusive. In fact, Luhmann would say that these processes are implicated in one another (see para. 4.1.3 below). Nietzsche believed that self-definition remains a requirement for any living form.¹⁰⁷

His idea of organic self is not identifiable with Kant’s representation of the individual. However, it could be argued that Nietzsche’s description of life as a ‘multiplicity of forces’¹⁰⁸ is derived from Kant’s description of living processes by reference to a ‘formative force’:

Hence an organized being is not a mere machine. For a machine has only *motive* force. But an organized being has within it *formative* force, and a formative force that this being imparts to the kinds of matter that lack it (thereby organizing them). This force is therefore a formative force that propagates itself – a force that a mere ability [of one thing] to move [another] (i.e., mechanism) cannot explain.¹⁰⁹

Kant represented biological individuality by reference to this ‘formative force’ that causes it to continuously evolve, rather than by reference to the idea of an unchanging identity that he employed to establish the transcendental unity of apperception. The idea of an ever-evolving self was reinforced by the subsequent development of evolutionary theory in which ‘the organism is not *given*, but *evolves*; it is always adapting, always changing. Thus, the very core issue of *identity* is for the first time raised as a problem.’¹¹⁰ Nietzsche also seems to have been influenced, at least to a certain extent, by evolutionary theory. He referred to Darwin occasionally in his work, although he perhaps had only a superficial understanding of his ideas.¹¹¹

Although Nietzsche elaborated a distinctly different notion of individuality than Kant, it could be said that he fulfils Kant’s critical project of striving for autonomy and ‘self-

¹⁰⁵ Goldstein (1995), p. 337.

¹⁰⁶ Canguilhem (1978), p. 76; Canguilhem (2006), p. 84.

¹⁰⁷ Nietzsche (1983), p. 63: ‘And this is a universal law: a living thing can be healthy, strong and fruitful only when bounded by a horizon; if it is incapable of drawing a horizon around itself, and at the same time too self-centered to enclose its own view within that of another, it will pine away slowly or hasten to its timely end.’

¹⁰⁸ Nietzsche (1968), p. 341.

¹⁰⁹ Kant (1987), p. 253, section 65, para. 374; See also Canguilhem (2002), p. 326.

¹¹⁰ Tauber (1994), p. 3.

¹¹¹ Ibid., p. 253. See, e.g., Nietzsche (1968), p. 344.

actualization' (see Chapter 2).¹¹² The main difference is that Nietzsche does not presuppose an existing unity or subject that can be 'freed' through an exercise of reason that relies on the assumption of such a unity. For Nietzsche, a self is only actualized or 'freed' by its self-overcoming (*Selbstüberwindung*).¹¹³

He does not accept the prior existence or assumption of an 'I'.¹¹⁴ Perhaps this is because his main preoccupation, unlike Kant, was not to provide a definitive theory of understanding or morality. Rather, Nietzsche elaborated his idea of a 'will to power' in order to question such theories.¹¹⁵ More importantly, he did not associate reason with *a priori* categories but with life:

'I' you say, and are proud of the word. But greater is that in which you do not wish to have faith - your body and its great reason: that does not say 'I', but does 'I'.¹¹⁶

Nietzsche, therefore, regarded the individual not as an existing being or an epistemological/moral construct. Rather, 'I' - and reason itself - only emerge from the process of living and can only be understood through living.¹¹⁷ Since this process necessarily involves a self-overcoming it simultaneously implies the overcoming of the particular idea of self that Kant established.

¹¹² Tauber (1994), pp. 232 and 290; Deleuze (1983), pp. 1 and 91: An important inspiration for Nietzsche's work was his idea that 'Kant had not carried out a true critique because he was not able to pose the problem of critique in terms of values'. This meant that Kant did 'not realize his project of immanent critique' in his *Critique of Pure Reason*. Nietzsche sought to take Kant's critique beyond itself to its logical conclusion, i.e.: freedom through self-overcoming.

¹¹³ Nietzsche (1971), pp. 122-126.

¹¹⁴ Tauber (1994), p. 249.

¹¹⁵ Ibid., p. 259: 'Nietzsche persistently seeks to declare the vital immediacy of being, the need for the full acceptance of the here and now and of the matrix of experience. The layers of morality and rationality that hide or encumber that primary encounter are stripped away'.

¹¹⁶ Ibid., p. 249, citing Nietzsche.

¹¹⁷ Ibid., p. 258, citing Nietzsche in relation to Being: 'Being - we have no idea of it apart from the idea of "living"'.

PART III

3.1 The history of the concept of the cell

3.1.1 *Subjectivity and ontology*

In what way does Canguilhem engage with Kant's and Nietzsche's respective representations of individuality? Different phases and aspects have been distinguished in his discussion on individuality. Lecourt, for example, describes three different phases in his work.¹¹⁸ First, he argues that Canguilhem represented the individual as a biological and ontological form. Second, he believes that Canguilhem abandoned this 'biologism',¹¹⁹ after the rise of molecular biology and came to identify the individual with a human being; especially in relation to medicine where the individual came to represent the suffering patient. Third, Lecourt believes that the notion of the individual was 'desubstantialized' by Canguilhem and became characterized by 'definitely Nietzschean overtones'.¹²⁰ Gayon differentiates three aspects of Canguilhem's discussion on individuality: normative, ontological, and epistemological.¹²¹

Although the multi-faceted nature and complexity of Canguilhem's discussion on individuality requires clarification, I argue that it is somewhat problematic to distinguish progressive phases and corresponding aspects that seem almost mutually exclusive. More specifically, with regard to Lecourt's account, I believe that Canguilhem's discussion on individuality should not be confused with subjectivity or with the role played by particular subjects in his work. I also believe that Canguilhem was not 'force[d] ... to abandon his attempt to elaborate a philosophical notion of individuality',¹²² as a consequence of developments in the life sciences. Rather, molecular biology and the introduction of the concept of information into the life sciences transformed the notion of the individual and made the 'problem of individuality' even more pressing (see Chapter 5).

With regard to Gayon's account, I believe that the representation of the individual as normative (understood in the specific sense that Canguilhem gives to that term)

¹¹⁸ Lecourt (1998), pp. 218 and 222.

¹¹⁹ Ibid., p. 218.

¹²⁰ Ibid., p. 222: 'its normativity is now its unrivalled capacity to create new norms within a balance of power that traverses it'.

¹²¹ Gayon (1998), p. 308.

¹²² Lecourt (1998), p. 218.

immediately and necessarily affects its ontological and epistemological status. In fact, I argue that the main objective of Canguilhem's notion of 'vital normativity' was precisely to transform the particular ontology and epistemology that had been associated with living processes since Kant (see Chapter 6).

Canguilhem's discussion of the individual resembles that of Kant only in the sense that both represent the 'problem of individuality' primarily as a problem of - and for - knowledge. Kant represented the reflective individuality of the 'unity of diversity' and the rational individuality of the subject as an answer to the question of how experience might be rendered intelligible. However, for Canguilhem individuality does not represent an answer or a solution. Rather, it represents a problem that precisely emerges from the impossibility of mapping a concept onto an identifiable entity. Canguilhem accepts that the conceptualization of an individual is never completely successful because the individual consists precisely of the negotiation of its boundaries. For him, the Kantian idea of the individual is immediately challenged by the impossibility of separating knowledge from life (or understanding from experience).

Before exploring the more original - and less discussed - aspects of Canguilhem's discussion on individuality, two of the most common misinterpretations of his notion of the individual are addressed. First, the idea that the individual represents a subject. Second, the idea that it represents an ontological entity. The search for a subject in his work is perhaps largely motivated by a desire to confront Canguilhem's own thought with itself. If a subject would form the centre of reference of his work, then this would confront Canguilhem with his own assertion that the subject is merely an expression of a certain type of rationality that he himself does not subscribe to.

The role of the subject has been associated with the patient that appears in Canguilhem's earlier work on medicine.¹²³ However, I argue that there is a difference between individuality and subjectivity in Canguilhem's work. This can be explained by reference to Goldstein's work *Der aufbau des Organismus*¹²⁴ which influenced Canguilhem's discussion on individuality and normativity. Goldstein's neurological patients and their pathologies inspired him to formulate his ideas on normality, pathology, and the individual

¹²³ Badiou (1998a), p. 229; Lecourt (1998), p. 222.

¹²⁴ Goldstein (1995).

norm.¹²⁵ However, his idea of the individual cannot be mapped onto any of his patients or any human subject. He himself says that his focus ‘is of course not “individualistic” in the sense of being egocentric. Our problem is not the person as an individual, but individuality’.¹²⁶ In other words, Goldstein’s patients inform his ideas and provide him with his data in much the same way as the patients in Canguilhem’s work on medicine inform the latter’s work. However, this does not mean that their respective theories of individuality should be identified with particular individual subjects.

Others believe that there is no subject at the centre of Canguilhem’s work. Rather, his work challenges the very notion of subjectivity. Badiou, for example, argues that Canguilhem’s idea ‘that the living prescribes the thought of the living is explicitly opposed to the assumption of a transcendental subject.’¹²⁷ Canguilhem’s suggestion that only the process of living can give rise to knowledge of life¹²⁸ echoes Nietzsche’s suggestion that reason can only be found in life. The consequence of this idea is that Kant’s subject and his *a priori* categories of understanding become almost irrelevant, or in any case inadequate, for the understanding of living processes. This argument also emerges as the main theme in Canguilhem’s book of essays appropriately entitled *La connaissance de la vie*.¹²⁹

Canguilhem observes that ‘to define life as a meaning inscribed in matter is to acknowledge the existence of an *a priori* objective that is inherently material and not merely formal’.¹³⁰ The idea of a material *a priori* or an *a priori* that is to be found in life is reminiscent of Aristotle’s idea of a material form (see Chapter 5). Although Canguilhem does not reason from subjectivity in the way that Kant does, Badiou notes how Canguilhem’s work does contain ‘a sort of formal schema or virtuality of the subject’ on the basis of which a fully-fledged subject may arise.¹³¹ This ‘virtual subject’ can be found, according to Badiou, in the ‘knot’ that is made up of ‘the three essential notions of centre, or centring, norm, and meaning’ that Canguilhem associates with individuality.¹³²

¹²⁵ Ibid., p. 15: ‘The intention to write this book goes back many years. It dates to that time of the world war when it became my special task as a physician to take under my medical care a great many patients with lesions of the brain. As the director of a hospital for brain-injured soldiers, my experiences compelled me to broaden the medical frame of reference to a more biological orientation’.

¹²⁶ Ibid., p. 338.

¹²⁷ Badiou (1998a), pp. 230-231.

¹²⁸ Canguilhem (2003), p. 16: ‘The thought of the *vivant* must take the idea of the *vivant* from the *vivant*’. (My translation).

¹²⁹ Ibid.

¹³⁰ Canguilhem (1994a), p. 317; See also Badiou (1998a), pp. 230-231.

¹³¹ Badiou (1998a), p. 226.

¹³² Ibid.

Canguilhem's individual has also been regarded as an ontological entity;¹³³ either as a being or a relation (between individual and environment).¹³⁴ The idea that the individual represents a relation rather than a singular entity has been derived from Canguilhem's statement that 'the individuality of a 'vivant' no more ends at its ectodermic boundaries than it begins with the cell'.¹³⁵ Lecourt notes how Canguilhem's representation of the individual as, at the same time, an absolute centre and a term in a relationship gives rise to a certain tension in his account of individuality.¹³⁶ However, Canguilhem's reference to the individual as centre performs a particular function. He observes:

Biology must, therefore, first understand the 'vivant' as a meaningful being and individuality not as an object, but as a character in the order of values. Living is '*rayonner*', it is to organize the milieu from a centre of reference that cannot itself be referred to without losing its original meaning.¹³⁷

Canguilhem regarded the individual as centre and as normatively absolute, not because it represents an ontological entity, but because the individual can only be explored by reference to itself. The living can only be understood through living, not through the Kantian principles of understanding or judgment:

Since in the knowledge of life there is a centre of reference that cannot be disputed, a centre of reference that one could call absolute. The 'vivant' is precisely a centre of reference. It is not because I am a thinking being or a subject, in the transcendental sense of that word, but because I am 'vivant' that I must seek the meaning of life in life.¹³⁸

Similarly, Canguilhem's representation of the individual as a term in a relationship performs a specific function. Such a representation of the individual is productive because it suggests that an individual is never identical to itself. Its identity shifts and changes in accordance with the changing relationship between it and its milieu.¹³⁹ However, Canguilhem observed that it is difficult to identify and separate the two terms - 'individual' and 'milieu' - in a relationship or interaction where such terms continuously change place:

¹³³ Lecourt (1998), p. 223; Greco (2005), p. 20: 'a vitalist ontology cannot but be an ontology of the contingent, of what is permanently suspended between being and non-being'.

¹³⁴ Gayon (1998), p. 308.

¹³⁵ Canguilhem (2003), p. 184 (my translation).

¹³⁶ Lecourt (1998), p. 220.

¹³⁷ Canguilhem (2003), p. 188 (my translation).

¹³⁸ Canguilhem (2002), p. 352 (my translation).

¹³⁹ Canguilhem (2003), p. 90: Gobineau does not 'conceive of individuality as a reality that is always identical to itself; he conceives of it as one term in a mobile relation'. Ibid, p. 184: 'The biological relation between a being and its milieu is a functional, and therefore mobile, relation in which the terms successively exchange roles'. (My translation).

[I]t is not without great difficulty, and by abstracting from a multitude of life's conditions, that we manage to detach, isolate, and consider the cell separately ... and even then it must itself be regarded as a milieu because it continues to represent a duality.¹⁴⁰

Too much emphasis on either individual or environment can lead to the representation of either term as an ontological entity rather than as something that emerges from that relation or interaction itself:

[I]n short, individuality is not a term if one understands by that word a limit. Rather, it is a term in a relation. One must not understand as a term in a relation, a term that is used in an inquiry that represents such a term as a being.¹⁴¹

We will now turn to some of the less addressed aspects of Canguilhem's discussion of individuality. These aspects together inform his questioning of the centrality of the individual as privileged centre of reference in the life sciences.

3.2 Aspects of individuality

3.2.1 *Continuity and discontinuity*

Canguilhem describes how the history of the concept of the cell has been animated by the continuous debate between two traditional strands of thought on the character of living processes. One strand of thought regards such processes as characterized by a certain continuity, while another regards them as characterized by discontinuity.¹⁴² As Canguilhem sees it, the concept of the cell arises from - and continues to envelop - this debate. The idea of the individual form emerges as a kind of 'discontinuous continuity', in the sense that particular individual forms disappear and re-appear while individuality itself continues to represent a problem or a question.

It is undoubtedly difficult, if not impossible, to identify the chronological priority of these two ideas of continuity and discontinuity in biology.¹⁴³ However, according to Canguilhem, the idea of living processes as continuous - often represented through a primordial tissue or membrane - is usually regarded as preceding the association of the living with discontinuity. Cellular theory is regarded as the primary example of a theory of

¹⁴⁰ Ibid., p. 91, citing Gobineau (my translation).

¹⁴¹ Ibid., p. 90 (my translation).

¹⁴² Ibid., p. 61.

¹⁴³ Ibid., p. 62: Canguilhem notes that it is only since Schwann that the two theories are thought of as distinct.

discontinuity regarding the living. As Canguilhem says, it represents life as 'a composition of parts, of organized atoms or grains of life' rather than 'a fundamental and continuous plastic substance'.¹⁴⁴

The difference between ideas of continuity and discontinuity has also been associated with the difference between the physical or chemical sciences and the biological sciences. Biologists inevitably, at some point, have to have recourse to discontinuity in order to demarcate the beginning of an individual organism. Jacob notes how this can be distinguished from the situation in the physical or chemical sciences where there is a general focus on the continuity of structures and substances:

For the chemist, in contrast, it is somewhat arbitrary to make a demarcation where there can only be continuity. Every organism contains a panoply of structures, functions, enzymes, membranes, metabolic cycles, energy-rich compounds and so on. Whatever the beginning assigned to what is called a living system, it is possible to envisage its organization only in an environment already prepared well in advance.¹⁴⁵

However, for biologists too it is often far from obvious how to approach the question of individuality. As Canguilhem's discussion on the problem of individuality shows, the demarcation or isolation of an individual is necessarily somewhat arbitrary. The limits of an individual cannot be easily determined or drawn between it and its environment because individuality extends beyond the imagined boundaries of an existing entity. As Canguilhem says:

The individual necessarily presupposes within itself its relation to a greater being, it calls for, it demands ... a background of continuity against which its discontinuity stands out. In that sense, there is no reason whatsoever to restrict the '*pouvoir*' of individuality to the limits of the cell.¹⁴⁶

The question is, then, precisely how or where to enter or interrupt a certain process. In other words: what should be regarded as the starting point of the individual and what as its end?¹⁴⁷ And if the individual is itself regarded as a process - whether as a normative process, a temporal process, or a process of emergence or differentiation - then how can such a process 'individuate' or be distinguished from other processes? This question is

¹⁴⁴ Ibid., p. 61 (my translation).

¹⁴⁵ Jacob (1976), p. 304.

¹⁴⁶ Canguilhem (2003), p. 89 (my translation); Canguilhem seems to have copied Bergson (1975), p. 5: 'Discontinuous though they appear, however, in point of fact they stand out against the continuity of a background on which they are designed, and to which indeed they owe the intervals that separate them.'

¹⁴⁷ Bateson (2000), p. 318, argues, by reference to the example of a blind man and his stick, that the question of where the self begins and ends is 'nonsense': 'because the stick is a pathway along which differences are transmitted under transformation, so that to draw a delimiting line *across* this pathway is to cut off a part of the systemic circuit which determines the blind man's locomotion'.

evoked by the frequent references in the contemporary life sciences to concepts such as 'system' and 'network' (see paras. 2.2.4 and 2.2.5 above).

Canguilhem loosely associates the distinction between theories of continuity and discontinuity with the French and German intellectual traditions, respectively. The reason for the comparatively late arrival of cellular theory in France is attributed by him to the long lasting influence of Bichat, who envisaged living matter as flexible tissue rather than as constituted by singular elements.¹⁴⁸ Canguilhem notes how the imagery that accompanies ideas about living processes as either continuous or discontinuous reinforces the apparent difference between the two strands of thought:

[T]he cell, endowed with its canonical hexagonal form, is the image of a whole closed in upon itself. But tissue represents an image of a continuity where every interruption is arbitrary, where something originates in an activity that is always open to continuation.¹⁴⁹

Whereas Bichat adhered to the idea of a '*continuité du fait vital*',¹⁵⁰ cellular theory relied on the idea of a largely self-sufficient or 'closed' individual entity. Cell theory represented the cell as the ultimate term of explanation or as 'biology's atom'.¹⁵¹

Although the difference between the two theories seems apparent and cellular theory is regarded as the primary example of a theory that represents living matter as discontinuous, Canguilhem believes that the concept of the cell is in fact a product of both theories. The conceptualization of the cell as primary individual form is characterized by how it holds discontinuity and continuity in tension. This is illustrated by how the cell has been regarded, since its emergence, as at the same time a primary material element (of all living organisms) and a cause (a cell generates another cell).¹⁵²

It is at the same time an instance or a manifestation of life - a discontinuity - and the continuous process of the formation and transformation that characterizes all living processes. It is this double meaning or ambiguity that the concept of the cell integrates within itself.¹⁵³ According to Canguilhem, what made the emergence of the concept of the cell possible was not the prior identification through the microscope of the cell as an

¹⁴⁸ Canguilhem (2003), p. 79.

¹⁴⁹ Ibid., p. 80 (my translation).

¹⁵⁰ Ibid., p. 81.

¹⁵¹ Jacob (2004), p. 136 : 'With the cell, biology has found its atom.' (My translation).

¹⁵² Canguilhem (2003), p. 85; Jacob (2004), p. 132.

¹⁵³ Canguilhem (2003), p. 63: 'a living unity which plays the role of principle in biology, in the double sense of primordial existence and reason of intelligibility' (my translation).

existing unity but precisely this - paradoxical - need for 'an element that is at the same time simple and *'vivant'*'.¹⁵⁴

3.2.2 *The imagery of the individual*

Another aspect of Canguilhem's inquiry into the history of the concept of the cell that can be used to shed light on his representation of individuality is his discussion of the imagery of the cell. Canguilhem argues that this imagery, and the values and emotions associated with it, contribute to the creation of a particular interpretation of individuality. He describes how the individual has come to be regarded as an identifiable and singular unity through the various ways in which it has been represented. He believes, however, that this representation can also be understood differently so that the individual emerges as a cooperative effort or a negotiation of boundaries rather than as a unity.

He begins by describing how the image of a monk's cell or the structure of a honeycomb that Hooke first observed through the microscope has become iconic:

[W]ith the cell, we are in the presence of a biological object whose affective over determination is incontestable and considerable ... Everyone will remember of their lessons in natural history the image of the cellular structure of living beings. This image has an almost canonical constancy.¹⁵⁵

The cell is often represented as a sphere because the sphere represents the typical organic form as distinguished from the 'crystalline units' that dominate imagery in the physical and chemical sciences.¹⁵⁶ However, the sphere perhaps also represents what Canguilhem refers to as the 'circularity' of the traditional representation of the biological individual by reference to the distinction between whole and parts.¹⁵⁷ He argues that Bernard was the first - through his concept of the '*milieu intérieur*' - to break this circular representation,¹⁵⁸ thereby opening up the possibility of a richer interpretation of biological individuality (see Chapter 2, para. 2.2.1).

¹⁵⁴ Ibid., pp. 90 and 59.

¹⁵⁵ Ibid. (my translation); Lecourt (1975), p. 135, referring to 'overdetermination' as 'an accumulation of contradictions'.

¹⁵⁶ Haraway (1976), p. 12: referring to Schleiden, the cell has even been referred to as an 'objectification of organic form'.

¹⁵⁷ Canguilhem (2002), pp. 328-329.

¹⁵⁸ Ibid., p. 329.

Although the traditional image of the cell represents it as a singular entity, Canguilhem asks the question of whether we do not - perhaps subconsciously - associate the image of the cell with cooperation rather than with isolation and autonomy:

[W]ho knows if by consciously borrowing the term 'cell' from the beehive to designate the element of the living organism, the human mind has not also borrowed from it - almost unconsciously - the notion of the cooperative work of which the honeycomb is the product? ¹⁵⁹

He observes how the cell was, initially, not associated at all with notions such as the 'self'. Such associations developed only later, Canguilhem implies, with the emergence of a particular idea of the individual in eighteenth-century philosophy and political theory. ¹⁶⁰

3.2.3 *Political philosophy and biology*

Rather than assuming the particular notion of individuality as it emerged in the eighteenth century, Canguilhem provides an alternative reading of the history of the concept of the individual. He focuses instead on the way in which Oken's representation of the cell was influenced by his Romantic political philosophy. ¹⁶¹ Oken, a German scientist-philosopher who played an important role in the elaboration of cell theory, did not associate the individuality of the cell with identity, unity, or autonomy. Rather, he envisaged the cell, as Canguilhem says, 'in the image of society, but this society is not the association of individuals conceived by the political philosophy of the "*Aufklärung*", it is the community conceived by the political philosophy of romanticism'. ¹⁶²

Contrary to the image of the individual that was proposed by philosophers of the Enlightenment, Oken regarded the cell as a singularity that could only exist as such by virtue of some form of cooperation or dependence on a greater whole. Whereas the cell was previously envisaged as a singular active agent, he emphasized the precarious nature of the cell as individual. Oken, it could be argued, announced the demise of the traditional notion of the autonomous individual and the simultaneous emergence of a different conception of individuality. ¹⁶³

¹⁵⁹ Canguilhem (2003), p. 60 (my translation).

¹⁶⁰ Ibid. (my translation).

¹⁶¹ Ibid., pp. 77-78; Jackson (1999).

¹⁶² Ibid., p. 77 (my translation).

¹⁶³ Ibid., p. 76. Klein citing Oken: 'No individuality is spared here, it is quite simply ruined. But that would be a misinterpretation; the reunited individualities together form another individuality, they are destroyed and other individualities only appear through their destruction.' (My translation).

Gayon believes that Canguilhem's discussion of political philosophy in relation to the concept of the cell fits within his description of two 'metaphorical models' through which the whole/part relationship has historically been thought: a technological model and a political model.¹⁶⁴ Although Canguilhem's discussion sheds light on the whole/part relationship in relation to the individual, I argue that this is not Canguilhem's main concern. I believe that Canguilhem refers to political philosophy for a much more significant reason; he uses it to illustrate two aspects of the problem of individuality.

First, individuality - understood as autonomy - is part of Enlightenment philosophy and can, therefore, also be understood otherwise. In order to understand individuality differently, or not focus on the individual as privileged centre, he uses the reference to Oken in order to repeat and affirm his previous argument (made in relation to the image of the cell as honeycomb) that 'what is certain is that emotional and social values of cooperation and association have a direct or indirect effect on the development of cellular theory'.¹⁶⁵ In other words, he questions the idea of the individual as an autonomous entity.

Second, Canguilhem shows how the emergence and transformation of the concept of the cell cannot be dissociated from the changing roles that the individual plays in political theory and philosophy.¹⁶⁶ This illustrates his idea that the 'problem of individuality' is indivisible and, therefore, not exclusive to any discipline.¹⁶⁷ Analogies between sociological conceptions of individuality and biological theories are valid because the political philosophy of the nineteenth century was inspired by a certain conception of life. Canguilhem argues that, at least in France, the proposal of the idea of a 'social contract' was accompanied by a particular idea of life as resistant to analytic dissection or individualization. In other words, biological theory inspired a political philosophy that - in turn - effected how biological individuality was conceived.¹⁶⁸

I argue that Canguilhem's own ideas about the focus on individuality in biology, and about the centrality of a certain *type* of individual, surface in his discussion of the history of the concept of the cell - for example, when he mentions how Novalis believed that universal

¹⁶⁴ Gayon (1998), p. 318.

¹⁶⁵ Canguilhem (2003), p. 61 (my translation) ; *Ibid.*, p. 78, Canguilhem repeats: 'That has already authorized us to affirm that social and emotional values have an effect on the development of cellular theory.' (My translation).

¹⁶⁶ *Ibid.*, p. 78.

¹⁶⁷ *Ibid.*, p. 79.

¹⁶⁸ *Ibid.*

suffrage 'atomized popular will and did not recognize the continuity of society or, more precisely, of community'.¹⁶⁹ He also refers to the idea espoused by Hegel - among others - that the State represents 'a fact that goes beyond the reason of the individual and to which the individual must sacrifice itself'.¹⁷⁰ Through such references, Canguilhem seems to want to provide an alternative to the focus on individuality - and on the individual as autonomous entity - in the life sciences. His discussion of the relation between Oken's political philosophy and his ideas on the biological individuality of the cell reveal how the traditional notion of the individual is an extension of Enlightenment philosophy that is open to questioning.

3.2.4 *The indivisible individual*

Canguilhem repeatedly observes that 'the problem of individuality is itself indivisible'.¹⁷¹ What does he mean by this statement? It seems out of place when, with the arrival of cell theory, a multitude of individuals emerged where previously there was only a single organism:

[T]his highly influential doctrine [Schwann's doctrine that attributed 'biological agency' to a single cell], combined with rapid improvement in the resolution and magnification power of microscopes, brought about an upheaval in the understanding of organismal individuality. Suddenly a whole new spectrum of potential individuals opened up.¹⁷²

The French biologist Prenant,¹⁷³ who is often cited by Canguilhem, observed that cellular theory gave rise to a situation where '*du haut en bas existe l'individualité*'.¹⁷⁴ Every individual was regarded as being made up of other individuals, and so forth, leading to a kind of infinite regress of individuality. The cell not only signified a single biological entity but implied an ever-extending individuality that reached well beyond the single individual cell. To some extent, the proliferation of individuals was represented as a necessary condition of life. As Prenant said: 'life is not possible without the individuation of the living'.¹⁷⁵

¹⁶⁹ Ibid., p. 78.

¹⁷⁰ Ibid., p. 79.

¹⁷¹ Ibid., pp. 79 and 89.

¹⁷² Parnes (2007), p. 321.

¹⁷³ Prenant (1935): Prenant was a professor of zoology at the Sorbonne and Communist Party member, who wrote a book on biology and Marxism.

¹⁷⁴ Canguilhem (2003), p. 89, citing Prenant.

¹⁷⁵ Ibid. (my translation).

Although many different degrees of individuality may have become visible and thinkable, Canguilhem repeats that the problem of individuality itself remains indivisible. The meaning and wording of this statement seem to differ slightly according to the context in which it is used. However, it is usually understood as a return to classic holism or to an Aristotelian idea of form.¹⁷⁶ Lecourt, for example, says that the introduction of the concept of information into the life sciences undermines the notion of such an indivisible individual:

[A]ll biochemists knew from this point on that the problem of individuality was eminently divisible. The notion of the individual therefore never again plays the central and totalizing role it had in Canguilhem's early works.¹⁷⁷

However, I believe that Canguilhem's reference to the indivisibility of the individual performs a different function. This can be explained by reference to his discussion of individuality in relation to the distinction between form and matter. The individual is, traditionally, either regarded as the ultimate material element that can no longer be divided¹⁷⁸ or as the form or 'whole' that is beyond all division:

[T]he individual is that which cannot be divided with regard to its form, although one senses the possibility of its material division. In certain cases, the indivisibility that is essential to individuality only reveals itself with the division of a being that is materially more vast, but is it only a limit to the division embarked upon, or is it rather *a priori* transcendent to every division?¹⁷⁹

Canguilhem's statement regarding the indivisibility of the 'problem of individuality' can be read more productively when it is regarded as primarily aimed at the conceptual schema that underlies the traditional idea of the individual as ontological entity. It proposes that the individual cannot be grasped through the traditional distinction between form and matter or the traditional relationship between whole and parts. In other words, that the problem of individuality cannot be divided is not because the individual represents the ultimately indivisible material part or the formal whole, but because it represents the impossibility of understanding processes of individuation through these traditional frameworks. The

¹⁷⁶ Aristotle (1998), Book Eta 3 (1043b), p. 240: 'Rather, if we take these latter to be the material components, there must be some additional entity, neither an element nor composed of an element, but just that very thing the removal of which leads to a purely material account. But if this entity is the cause of being and substance for the object, then it is the account of this that is the account of the substance itself.'

¹⁷⁷ Lecourt (1998), p. 222.

¹⁷⁸ Haraway (1991), p. 216, referring to Dawkins discussing Huxley who 'defined individuality in biological terms as "literally indivisibility - the quality of being sufficiently heterogeneous in form to be rendered non-functional if cut in half"'; Luhmann (1996), p. 257.

¹⁷⁹ Canguilhem (2003), p. 78 (my translation); This is probably inspired by Aristotle discussing form in relation to 'natural entities'. Aristotle (1998), Book Zeta 8 (1034a), p. 196: 'this sort of form in this very flesh and bones that is Callias or is Socrates. They differ materially (their matter is different), but they are formally the same (indivisibility of the form)'.

individual cannot be understood by reference to the traditional characteristics of unity or identity. Rather, it should be understood as process; as Nietzsche would say, a process of 'self-overcoming'.

This idea is productive at a time when the focus on individuality in contemporary biology is at the same time contested and repeated in different forms. The individual is no longer regarded as part, as a whole or sum of parts, or as something that is *more* than the sum of parts. Such traditional representations of individuality relied on, and could still be understood through, the relationship between whole and parts. Individuals could be identified as such as long as reference was made to the original 'whole' that they were divorced from or that they were thought to form in combination.¹⁸⁰ Contemporary biology seems to rely less and less on such representations of the individual and more on systems, networks, pathways, and contingent processes. Nietzsche and Canguilhem's respective interpretations of individuality as a process, therefore, regain significance.

PART IV

4.1 The individual as process

4.1.1 Simondon: 'l'individu n'est pas un être mais un acte'

This statement by Simondon¹⁸¹ expresses most clearly what remains to some extent implicit in both Nietzsche's and Canguilhem's work: the individual is not a being or an actual form that persists through time but a mechanism or a process. The reference to '*acte*' is not to be understood as the intentional action of a subject but as a process of individuation. Simondon is often referred to as the first philosopher to have developed a specific philosophy of individuation. His work became known to a larger audience through references to it by Deleuze.¹⁸² His work entitled '*L'individu et sa genèse physico-biologique (l'individuation à la lumière des notions de forme et d'information)*'¹⁸³ addresses processes of individuation in physics and biology. The most significant aspect of this work

¹⁸⁰ Cf. Pottage (2002), p. 293: 'The 'original' contiguity of person and biology is maintained either by referring to body parts *as* parts, thereby re-iterating the *process* of detachment so as to maintain the sense of an original unity.'

¹⁸¹ Simondon (1964), p. 197. Simondon was a former student of Canguilhem and a professor of psychology at the Sorbonne.

¹⁸² Deleuze (1997), p. 26; Deleuze & Guattari (1999), pp. 408-409 and p. 555 (note 33).

¹⁸³ Simondon (1964).

is how it seeks to move beyond the traditional notions that have dominated most discussions on individuality, namely the distinction between form and matter (the ‘hylomorphism’ that Simondon attributes to Aristotle) and the idea of the individual as ontological entity.¹⁸⁴

Canguilhem refers to Simondon’s work in a footnote in the second edition of *‘La Connaissance de la vie’*, apparently without exploring his ideas on individuation further.¹⁸⁵ According to Lecourt, Canguilhem sought to ‘import’ Simondon’s ideas on individuation into his own concept of the individual in order ‘to rid the notion of the individual of its Aristotelian ontological ballast’.¹⁸⁶ However, it often goes unnoticed that Simondon’s exploration of individuation is in fact a further elaboration of Canguilhem’s discussion of individuality as a problem.¹⁸⁷

Most notably, Simondon took his main argument that ‘the individual emerges only as the result of a process of individuation, and it is futile to look for the principle in the form taken by the result’¹⁸⁸ from Canguilhem who said that the individual can only ever be regarded as a consequence or a product rather than a principle.¹⁸⁹ Although the similarities between their respective theories are more apparent than their differences, these differences exist nonetheless. For example, it has been noted that whereas the location of individuality represented a question for Canguilhem it is no longer relevant for Simondon.¹⁹⁰ However, I believe that this puts too much emphasis on a supposed localization of the individual in Canguilhem who was - arguably - more interested in the process of normativity than in the localization of either individual or environment as substantive unity.¹⁹¹

The most prominent difference between Canguilhem and Simondon is perhaps that the former’s discussion of individuality is influenced by his notion of ‘vital normativity’, whereas Simondon describes the individual as a predominantly temporal process.

¹⁸⁴ See, e.g., for commentary on Simondon’s contribution: Stiegler (1998); Combes (1999); Barthélémy (2005).

¹⁸⁵ Canguilhem (2003), p. 99 (n. 1): ‘Since these lines were written, the thesis of Mr. Gilbert Simondon, *L’individu et sa genèse physico-biologique*, Paris, P.U.F., 1964, has fortunately contributed to the elucidation of these questions.’ (My translation).

¹⁸⁶ Lecourt (1998), p. 222.

¹⁸⁷ Barthélémy (2005), p. 159, notes Canguilhem’s references to Simondon and the latter’s references to Canguilhem, but does not explore the substance of their ideas and their mutual influence in any detail.

¹⁸⁸ Lecourt (1998), p. 222.

¹⁸⁹ Canguilhem (2003), p. 70.

¹⁹⁰ Barthélémy (2005), p. 177.

¹⁹¹ See para. 3.2.1 above for his reference to the individual as ‘centre’ and Chapter 3, para. 1.2.2, for the idea of environment as localizable space.

According to Simondon ‘the relation between “*actes*” does not take place at the abstract level of norms’.¹⁹² However, his observation that ‘being is not entirely contained in its principle, or rather in its principles; being develops from its principles but its principles are not given in its system’¹⁹³ can be regarded as explaining the difference between Aristotelian form and Canguilhem’s idea of normativity. Whereas the former is often regarded as a form that is inherent in living processes, the latter signifies processes or techniques of living that are not prior to their execution or actualization. Simondon, therefore, seems to agree with Canguilhem’s notion of normativity as the normative order of an organism that continuously transforms to meet the demands of a particular situation (see Chapter 6). His reference to the individual as ‘*acte*’ is not as far removed from Canguilhem’s discussion of the ‘*norme*’ as one would think.

What drives Simondon’s theory of individuation is the recognition of the problem, previously identified by Canguilhem, that most theories assume the existence of the individual that they seek to explain.¹⁹⁴ He tries to avoid this problematic point of departure by according no primary significance to the individual. Rather, Simondon focuses on the idea that individuation is a temporal process in which the individual merely represents a phase or a moment.¹⁹⁵ Because the individual cannot be presupposed as object of inquiry, the process of individuation itself cannot be understood through the individual. Rather, the individual must be understood through the process of individuation.¹⁹⁶ This process is purely potential, in the sense of unspecified or undifferentiated, because it gives rise to both individual and environment.¹⁹⁷

Since the individual is not assumed from the outset, it cannot be regarded as an ontological entity that progresses or transforms through time. Rather, the individual is, as Simondon says, ‘contemporary of its own becoming’.¹⁹⁸ He avoids the idea, most often associated with Hegelian dialectics, of ‘*devenir*’ as a future or goal that is to be obtained and that exists separate from the individual.¹⁹⁹ Time is not prior - or posterior - to the process of

¹⁹² Simondon (1964), p. 297 (my translation) ; Barthélémy (2005), p. 40: Simondon proposes the ‘hypothesis according to which the living being is an individuation understood as phase and no longer as regime’. (My translation).

¹⁹³ Simondon (1964), p. 197 (my translation).

¹⁹⁴ Combes (1999), p. 8.

¹⁹⁵ Simondon (1964), p. 273.

¹⁹⁶ *Ibid.*, p. 4.

¹⁹⁷ *Ibid.*, pp. 281-282.

¹⁹⁸ *Ibid.*, p. 277.

¹⁹⁹ *Ibid.*, p. 278.

individuation. Rather, time itself comes into being through individuation.²⁰⁰ Nevertheless, Simondon seems - at first glance - to embrace a linear notion of time because he describes a development in phases from the '*pré-individuelle*',²⁰¹ which he describes as the principle of the process of individuation, to the individual as end result. His description of the process of individuation can, therefore, be misread as a progressive process of identification.

Similar to Canguilhem's approach to individuality as a problem, Simondon regards the individual as enveloping 'an internal problematic'.²⁰² This is because an individual never represents 'the whole being',²⁰³ but always retains an 'incompatibility in relation to itself'.²⁰⁴ In other words, the individual never entirely coincides with itself or with its concept, because it 'conserves within itself an activity of permanent individuation'.²⁰⁵ The idea of the individual as an ongoing process of individuation or self-formation also indicates, as it did in Canguilhem's work, that individuality recurs as a question. As Simondon observes, 'the individuated being is not substance but being put into question'.²⁰⁶ In a remark that echoes Canguilhem's idea that the individual is at the same time object of - and obstacle to - inquiry, Simondon says that the individual represents at the same time a question and its 'provisional solution'.²⁰⁷ Like Canguilhem, Simondon does not focus on the identity of the individual because the individual is 'richer than its own coherence'²⁰⁸ and exceeds its own limits.²⁰⁹

4.1.2 Foucault : 'techniques de soi'

Foucault, following Nietzsche and Canguilhem, elaborates a particular idea of individuality (if it can still be called by this name) by reference to ancient Greek Stoicism. Some have regarded Foucault's idea as a return to - or reinvention of - the subject, after he had previously challenged the notion of the self and subject that existentialists such as Sartre

²⁰⁰ Barthélémy (2005), p. 57, notes the significance of the idea that 'genesis is not in time but that which gives rise to time' (my translation).

²⁰¹ Simondon (1964), p. 2.

²⁰² Ibid., p. 11 (my translation).

²⁰³ Ibid., p. 4 (my translation).

²⁰⁴ Ibid., p. 5 (my translation).

²⁰⁵ Ibid., p. 9 (my translation).

²⁰⁶ Ibid., p. 277 (my translation).

²⁰⁷ Ibid., p. 272 (my translation); Combes (1999), p. 13.

²⁰⁸ Simondon (1964), p. 284.

²⁰⁹ Ibid., p. 285: it is 'simultaneously coupled to itself within a system that exceeds unity, which is more than one' (my translation).

relied on.²¹⁰ It is certainly true that subsequent interpretations of Foucault's work have taken his discussion of 'the relationship of self with self'²¹¹ to refer to a subject and its self-formation. Foucault's original idea of the '*rapport à soi*'²¹² and '*techniques de soi*'²¹³ is taken literally, for example by Rose, in order to imagine the 'self-techniques by which human beings should judge and act upon themselves to make themselves better than they are'.²¹⁴

To a certain extent, such interpretations are understandable because Foucault speaks about the '*rapport à soi*' in relation to the 'forming of oneself as a subject'.²¹⁵ The relation of self to self, or the 'principle of the care of the self',²¹⁶ is constituted by practices and techniques rather than laws or moral codes.²¹⁷ However, before the significance of such practices and their historical particularity can be assessed, it is necessary to appreciate the form of individuality that underlies these practices or techniques and makes them possible. It is necessary, Foucault believes, to take 'such a form into account',²¹⁸ a form that he believes has a long history that can be traced back to ancient Greece.²¹⁹

The form that Foucault describes as the '*rapport à soi*' cannot be identified with subjectivity, nor can it be identified with the traditional idea of individuality. He begins his inquiry with the suggestion that 'we may wonder about the reality of that individualistic upsurge',²²⁰ and goes on to say that "'individualism" ... is so frequently invoked, in different epochs, to explain very diverse phenomena. Quite often with such categories entirely different realities are lumped together.'²²¹ The relation of self to self that Foucault focuses on should be distinguished from the individualism where the individual is regarded as a singular and autonomous entity or subject.²²²

²¹⁰ Hacking (2004), p. 288.

²¹¹ Foucault (1992), p. 6.

²¹² Foucault (1984b), p. 12.

²¹³ Ibid., p. 17.

²¹⁴ N. Rose (2007), p. 27, in relation to what he calls 'ethopolitics'.

²¹⁵ Foucault (1992), p. 6.

²¹⁶ Foucault (1990), p. 43.

²¹⁷ Ibid., p. 45: 'It also took the form of an attitude, a mode of behaviour; it became instilled in ways of living; it evolved into procedures, practices, and formulas that people reflected on, developed, perfected, and taught'.

²¹⁸ Ibid., p. 41.

²¹⁹ Ibid., p. 43.

²²⁰ Ibid., p. 41.

²²¹ Ibid., p. 42.

²²² Ibid.: Foucault mentions three interpretations of 'individualism' that should be distinguished (the autonomous individual, private life and family relationships, and relations to self); although connections between these forms are possible, they are not necessary.

I believe that there is a significant difference between the 'self' of the existentialists or the Kantian subject and Foucault's discussion of a relation of self to self. Deleuze also argued that Foucault did not seek to reinvent the subject with his discussion of the techniques of the self.²²³ Rather, Foucault's '*rapport à soi*' represents a particular form or - as Deleuze calls it - a '*nouvelle dimension*'²²⁴ that signifies the escape from, or transformation of, traditional accounts of knowledge and power.

Foucault associated the '*rapport à soi*' with reason, freedom, and the resistance to regimes of knowledge and power. Although he refers to the Greeks rather than to Kant, Foucault comes close to Kant when he says that

because the god [Zeus] deemed it right that he be able to make free use of himself; and it was for this purpose that he endowed him with reason ... it is this absolutely singular faculty that is capable of making use of itself, for it is capable of 'contemplating both itself and everything else' ... It is insofar as he is free and reasonable that man is the natural being that has been committed to the care of himself.²²⁵

However, Foucault believes that Kant's reason - because it is necessary and *a priori* - ultimately turns into the dogmatism and tyranny it sought to oppose (see Chapter 2). Deleuze argues that, although the '*rapport à soi*' runs the risk of being integrated into traditional regimes of knowledge and power,²²⁶ its redeeming feature is that it is not a transcendent form (like Kant's *a priori* principles) but that it continuously changes form.²²⁷

4.1.3 The autopoietic 'system'; individuality as differentiation

Autopoietic theory is primarily concerned with 'the organization of the individual as the central question for the understanding of the organization of living systems'.²²⁸ This means that, like Kant, the individuality of the system or organism is primarily described as an epistemological problem. It is important to note that organization is regarded as a process, rather than a structure, from which the system emerges. This understanding of biological individuality as an 'on-going activity' is somewhat different from the organization of the

²²³ Deleuze (2004), p. 113.

²²⁴ Ibid.

²²⁵ Foucault (1990), p. 47, citing Epictetus.

²²⁶ Deleuze (2004), p. 110.

²²⁷ Ibid., p. 111.

²²⁸ Maturana & Varela (1980), p. 87.

living that was described by Kant when he observed that the individual is its own cause and effect.²²⁹

Heidegger describes 'poiesis', in relation to artistic creations and living processes, as a process: 'the arising of something from out of itself, is a bringing-forth, *poiesis*'.²³⁰ He argues that living processes represent poiesis in the 'highest sense', because they bring forth themselves while artistic creation relies on an external agent.²³¹ Varela describes how this process of bringing-forth implies a continuous process of differentiation: 'a living system makes itself into a entity distinct from its environment through a process that brings forth, through that very process, a world proper to the organism'.²³² The idea of autopoiesis as a process of differentiation is explored by Luhmann who turns the distinction between system and environment into the central presupposition of his social theory.²³³

It has been noted how the founders of autopoietic theory sought to 'preserve the central features of autonomy and individuality while still wrenching them out of the Cartesian and Enlightenment frameworks in which they are embedded'.²³⁴ The idea of individuality as a central question is maintained, but the notion of individuality is transformed. Although the autonomy of the system is regarded as central, autopoietic theory does not assume an already existing autonomy. Rather, it is concerned with the mechanisms through which such autonomy is constituted and can be understood. This means that autonomy always remains that which is in need of explanation: 'autonomy, although continuously revealed in the self-asserting capacity of living systems to maintain their identity through the active compensation of deformations, seems so far to be the most elusive of their properties'.²³⁵ Autopoietic theory ultimately seeks to provide

a proper account of the constitution of an *autonomous* self ... We need to avail ourselves of more powerful explanatory devices to see how such a self can, at the same time, be a *virtual* point with no localized coordinates, and yet provide a mode of identity through which an interaction can happen.²³⁶

²²⁹ Tauber (1991), pp. 30 and 27; Kant (1987), p. 249, section 64, para. 370.

²³⁰ Heidegger (1977), p. 10.

²³¹ Ibid., pp. 10-11.

²³² Varela (1991), p. 79.

²³³ Luhmann (1998), p. 33: 'The theory proceeds by assuming the distinction between system and environment.'

²³⁴ Hayles (1999), p. 132 ; *ibid.*, p. 143: 'liberal subjectivity is both contested and reinscribed in autopoietic theory.'

²³⁵ Maturana & Varela (1980), p. 73.

²³⁶ Varela (1991), p. 79.

The autonomy of the system as centre of reference is regarded as a necessity, as Canguilhem previously noted, for relations, processes, and networks to be understood. He described how the individual represents an absolute centre of reference that, nevertheless, cannot be localized or referred to without losing its function (see para. 3.1.1 above). Varela also discusses this ‘apparent paradox of non-localization liable to designation as a totality’.²³⁷

Varela refers, in relation to immunology discourse, to the need for a ‘*selfless* self’ as an alternative to the self/non-self distinction that traditionally dominated immunology discourse (see para. 2.2.2 above).²³⁸ He describes how the unity of the autopoietic system is not defined against something else but is a ‘self-referential, positive assertion of a coherent unity’.²³⁹ The unity of the system represents the process of differentiation rather than an ontological entity; it is an ‘operative notion’.²⁴⁰ This means that unity is only the consequence or effect of a mechanism or process of self-definition and description. Nevertheless, the existence or emergence of unity is a requirement for the reproduction of a system²⁴¹ and its maintenance is an organizational necessity.²⁴² This does not mean that the unity or identity of a system remains stable. The maintenance of a unity inevitably requires transformation and this is what the ongoing process of autopoiesis represents.

This idea of the autopoietic individual as an ongoing process of self-definition begs the question of how an individual form emerges in the first place:

‘[T]he true problem is not how an organism and its environs interact or connect but, rather, the opposite one: how does a distinct self-identical organism emerge out of its environs? How does a cell form the membrane that separates its inside from its outside? The true problem is thus not how an organism adapts to its environs but how it is that there is something, a distinct entity, that must adapt itself in the first place.’²⁴³

However, Luhmann describes how traditional origin scenarios are purposefully avoided in autopoietic theory. The question is not how a system comes into being - it is not an

²³⁷ Ibid., p. 100.

²³⁸ Ibid., p. 95.

²³⁹ Ibid., p. 88.

²⁴⁰ Maturana & Varela (1980), p. 96: ‘Unity distinction [the distinctiveness and distinguishing of unity], then, is not an abstract notion of purely conceptual validity for descriptive or analytical purposes, but it is an operative notion referring to the process through which a unity becomes asserted or defined.’

²⁴¹ Ibid.: ‘reproduction requires the existence of a unity to be reproduced, and it is necessarily secondary to the establishment of such a unity’.

²⁴² Ibid., p. 97: ‘autopoiesis implies the subordination of all change in the autopoietic system to the maintenance of its autopoietic organization, and since this organization defines it as a unity, it implies total subordination of the phenomenology of the system to the maintenance of its unity’.

²⁴³ Žižek (2003), p. 116.

ontological entity that exists within a linear conception of time - but how it operates through mechanisms of differentiation.²⁴⁴

Similarly to Canguilhem, Luhmann questions the traditional notion of the individual as a social category through his idea of the 'system'. In his theory, the tension between Kant's traditional representation of individuality by reference to identity, unity, and autonomy and Nietzsche's and Canguilhem's idea of individuality as a process of self-overcoming becomes apparent. Luhmann, like Kant and his idea of a 'unity of diversity', regards the notion of the 'system' as a response to a primarily epistemological problem. He does not claim that the world is made up of individuals called systems. Rather, the system represents an epistemological tool through which certain processes can be understood.

As opposed to original autopoietic theory and Kant's understanding of the unity of diversity, he does not limit the applicability of the notion of the 'system' to either living processes or artistic creation. In Luhmann's systems theory, the unity and individuality of the system is perceived as such through the external perspective of the observer who perceives the individual as an actual form (or a unity of difference) rather than a technique of differentiation. Although the idea of unity represents somewhat of a theme in Luhmann and unity is replicated across systems, it never comes to represent an actual form but only denotes a process of differentiation or self-description.

Similarly to Canguilhem, Luhmann addressed how the relation between whole and parts is an unsatisfactory model through which to explore the 'indivisibility' or systematic character of the individual.²⁴⁵ He replaces this schema of whole and parts with the primary difference between system and environment. This means that a system is not a unity composed of parts but 'is composed of a relatively large number of operationally employable system/environment differences'.²⁴⁶ This means that, similarly to Nietzsche, Goldstein, and Canguilhem, Luhmann regards the individuality of the system as a process

²⁴⁴ Winthrop-Young (2003), p. 312: 'Given that autonomy is the prerequisite as well as the effect of differentiation, it makes little sense to ask how something autonomous evolved from non-being into being. From Luhmann's point of view this is a useless chicken-and-egg question, and rather than "search for the egg from which it emerges, the chicken should lay another and cackle".' (Citing Luhmann); Ibid., p. 323: Moreover, 'the beginning/end distinction defines a period, the before/after distinction defines an event'. Luhmann's theory does not follow a linear conception of time but operates through events.

²⁴⁵ Luhmann (1996), p. 27: 'The questions accompanying this - for example, How is a "whole" composed of "parts"? and Where in this is the "more than the sum of its parts" to be found? - are replaced by a completely different understanding of complexity, one that must be formulated entirely as difference in complexity.'; see also *ibid.*, p. 5.

²⁴⁶ *Ibid.*, p. 7.

of self-overcoming through continuous differentiation and distinction rather than as a process of self-preservation.

CONCLUSION

The individual, or individuality, represents the traditional object of inquiry in both the life and social sciences. However, for some time now, the individual - understood as ontological entity - has been regarded as an unsatisfactory concept to address recent developments in these fields. In particular, the introduction of the concept of information has allegedly rendered the idea of the ontological individual obsolete, while a focus on the environment seems to indicate that the individual has lost its role of privileged centre.

The focus on the fragmentation of the traditional individual form through technological developments has, I have argued, given rise to an absence of theory regarding individuality in the life and social sciences. The individual is only thought in relation to the transformation of subjectivities and the emergence of new biological entities. However, at the same time, individuality persists or recurs as a question through the emergence of various narratives of individuation and through reference to notions such as 'system' and 'network'.

Canguilhem inquired into, what he called, the 'problem of individuality' which he discussed through the history of the concept of the cell. I have argued that he turns the individual into a paradigm; he uses the notion of the cell as a manifestation of individuality in order to elucidate the wider historical and social problematic associated with individuality. The individual is shown to be a category that flips over between biology and the social sciences; informing both notions of organism and 'self'.

It has been argued that the characteristics that are traditionally associated with the individual - identity, unity, and autonomy - can be traced back to Kant's discussion of the subject as the centre of reference of his theory of understanding and the unity of diversity represented by the empirical world. I have argued that these ideas still influence perceptions of the individual in the life sciences, as illustrated by reference to changing subjectivities, the gene and system as privileged individual forms, and notions of networks and pathways. I have argued that Nietzsche's ideas in relation to the living represent an

alternative to Kant by focusing on self-overcoming rather than self-preservation. These ideas influenced both Goldstein's and Canguilhem's accounts of individuality in the life sciences.

Canguilhem's discussion of individuality as a problem in his essay '*La théorie cellulaire*' is usually associated with the description of the individual as an ontological form. However, I have discussed three - less explored - aspects of Canguilhem's discussion that reveal how he proposes a different notion of individuality. First, the individual represents a discontinuous continuity; something that individuates in different forms but represents an enduring philosophical question. Second, Canguilhem reveals how the imagery of the cell influenced and reinforced a particular representation of the individual. The connection between the biological individuality of the organism and the emergence of the autonomous individual in eighteenth-century philosophy and political theory shows how the focus on the individual as privileged centre of reference is itself representative of a certain rationality or normative preference. Third, he describes the problem of individuality as indivisible, thereby indicating that the individual cannot be grasped through the traditional framework of whole and parts.

The idea of the individual as process has been further explored by reference to Simondon's discussion of individuation as a temporal process, Foucault's description of the relation of self to self, and the autopoietic system as a process of differentiation. The contemporary life sciences that focus on individuation as a process without recourse to the notion of an ontological entity can benefit from Canguilhem's discussion of individuality as a problem. His discussion also reveals the normative assumptions that are implicit in any theory that focuses on the individual as centre of reference. In the next Chapter, the concept of information is addressed that has been associated with so many transformations in the life sciences - including the transformation of the notion of the individual.

5. INFORMATION

PART I

1.1 Introduction

1.1.1 Information in contemporary biology

The notion of information, characterized mostly by its different meanings and employments, had a significant influence on the life and social sciences during the second half of the twentieth century. Many believe that this notion has transformed traditional understandings of knowledge, power, economy, and critique.¹ However, the notion of information seems to have run out of steam.² Some of the consequences of its use in the life sciences, for example the introduction of the distinction between ‘genetic information’ and environment as well as its role as a disputed metaphor, have called its productivity into question.³

Why would it be useful to return to this concept? And why would we do that through Canguilhem’s work? It is generally believed that he largely disregarded the notion, that he misunderstood it, or that he equated it with Aristotle’s idea of form (understood as an unchanging pattern or teleological principle).⁴ I argue that Canguilhem’s ideas on information are useful when understood within the context of his engagement with modern rationality and the relation between knowledge and life that defines it.

Kant regarded knowledge or understanding and living processes as distinct processes that were subject to different principles and regimes (see Chapter 2). Canguilhem refocuses the debate by suggesting that the Kantian distinction between knowledge and life is undermined by the introduction of the notion of information into the life sciences. This notion of information does not necessarily facilitate control over living processes,

¹ See, e.g., Lyotard (1979); Kay (2000); Castells (1996), (1997), and (1998); Lash (2002).

² N. Rose (2007), p. 47; Rabinow & Caduff (2006), p. 330.

³ Griffiths (2001).

⁴ N. Rose (1998), p. 162; Lecourt (1998), p. 223.

as is usually suggested, but complicates the notions of knowledge and control themselves.

To a certain extent, the question of control necessarily emerges in relation to the sciences.⁵ However, the theory of cybernetics - as it emerged during the Second World War - transformed what was once meant by both information and control. Galison observes that Wiener, the founder of cybernetics, emphasized 'the dual aspect of information'.⁶ Information was no longer regarded as part of a 'knowledge-gathering exercise' but as part of the constitution and functioning of 'control systems' that could be either animate or inanimate. Cybernetics represented, as Kay suggests

a new form of technological epistemology. Its central notion was that problems of control and communication engineering were inseparable – communication and control being two faces of the same coin – and centered on the fundamental notion of the message, a discrete or continuous sequence of measurable events disrupted in time. Control qua feedback was nothing but the sending of messages that affect behavior.⁷

Although the conception of control in cybernetics may have been initially inspired by a traditional desire to create scientific order out of natural chaos,⁸ the idea of control itself did not signify control that is exercised 'over' living processes. Rather, it involved the functioning and predictability of systems themselves. The notions of control and information no longer had the same meaning as they did before: 'control was abstracted and diffused: it was not a thing but a manifestation; not a mode of decision making but a process pervading the whole system.'⁹

It is often suggested that the introduction of the notion of information into the life sciences gives rise to new ways of knowing and controlling living processes, whether such control takes a legal form (through property mechanisms), a political form (through policy interventions), a scientific form (through informatic databases), or an economic form (through the capitalization of biological 'products').¹⁰ The concept of information in the life sciences would give rise to a new form of 'biopolitics' (see para. 1.1.2 below).¹¹

⁵ Rheinberger (1997a), p. 102.

⁶ Galison (1994), p. 256.

⁷ Kay (2000), p. 84-85.

⁸ Galison (1994), p. 266.

⁹ Kay (2000), p. 85-86.

¹⁰ Eisenberg (2002); Jasanoff (2005); Thacker (2004); Parry (2004a) and Sunder Rajan (2006).

¹¹ See Foucault (1997), p. 216; Foucault (1998), p. 139 on the original idea of 'biopolitics'.

I argue that such an association of information with an, often conceptually simplistic, notion of control is not particularly productive. It does not take account of the transformations that both notions have undergone and the way in which information and control are implicated in each other. Rather, such ideas rely on two assumptions that may no longer be valid.

First, most inquiries focus on the form/matter distinction. Information is often associated with Aristotelian form; it is, then, suggested that information makes control of the very essence or 'form' of living processes possible. I argue that Aristotle elaborated the notion of form precisely in order to challenge the form/matter distinction, thereby indicating a slippage between the ancient idea of form and the modern idea of information.

Second, the understanding of control remains locked in a Kantian metaphysics - or '*horizon logique*'¹² - with its distinctions between concept and life, norm and fact. This means that control is represented as a power that is exercised *over* living processes. Such an idea does not take into account how information and control are already implicated in the exercise of knowing life.

In this Chapter, I draw mainly on Kay's exploration of the concept of information in the life sciences because in my view it constitutes the most sophisticated account of its emergence and particular use in this field.¹³ Kay associates the emergence of the concept of 'information' with the evolution of technology and the elaboration of information and communication theories after the Second World War¹⁴ and indicates how the notions of information and control are inextricably linked.

1.1.2 Information and control

The reason for the particular convergence between information technology or communication sciences and contemporary biology has been explained through the idea that both

¹² Canguilhem (2002), p. 343: 'The logical horizon, according to Kant, is the circumscription of a territory through a conceptual point of view.' (My translation).

¹³ Kay (2000).

¹⁴ See, e.g., *ibid.*, pp. 91-102.

are constructed by a common move - the translation of the world into a problem of coding, a search for a common language in which all resistance to instrumental control disappears and all heterogeneity can be submitted to disassembly, reassembly, investment and exchange.¹⁵

What seems to be at issue is a causal relationship between an increased fragmentation of living processes and an increased possibility of control.

The traditional conceptualization of the organism as an individual whole seems to have given way to the transformation of living processes into 'a mutable, sortable, comparable set of elements, a living body figures in bioinformatics as a somewhat abstract relational entity, potentially open to many different determinations.'¹⁶ Living processes in such technological forms are characterized by their potential to 'move, modify, recombine',¹⁷ which - it has been argued - makes it easier for them to be controlled and manipulated.

The question that is asked is: how does this new perception of living processes as information affect previous understandings of control?¹⁸ This apparently does not take into account the question that was addressed by cybernetics, namely, how can the relation between both notions be understood and reconceptualized so as to shed light on the purposeful behaviour of systems? Many inquiries focus instead on the movement, mobility, and acceleration with which living processes have come to be associated.¹⁹ This affects the traditional understanding, as discussed by Kay, of control as centralized.²⁰ Foucault, of course, describes a similar transition from a form of power that is localizable in the sovereign to a form of 'biopower' that is perhaps ubiquitous but not localizable in a traditional sense.²¹

The distinctive feature of the movement that is now associated with living processes is, arguably, that it is 'lateral' rather than 'linear'.²² Although these terms are seemingly attributed directly to such processes or their movement, Pottage observes how the

¹⁵ Haraway (1991), p. 164.

¹⁶ Mackenzie (2003), p. 317.

¹⁷ Parry (2004a), p. xix.

¹⁸ Helmreich (2003), pp. 341-342.

¹⁹ See *ibid.*, pp. 342 and 352 on the importance of the notion of 'transfer' in contemporary biology; McKenzie (2006).

²⁰ See, e.g., Kay (2000), p. 5: 'The genetic code became the site of life's command and control.'

²¹ I argue in Chapter 6, para. 2.2.3, that the difference between forms of power described by Foucault is not limited to location.

²² Pottage (2006), p. 139; Helmreich (2003); McKenzie (2003), p. 321.

distinction between 'linearity' and 'laterality' is drawn within discourse. It represents a certain 'mode of articulation' that gives rise to 'productive tensions'; for example, when there is a discordance between lateral description and linear modes of representation.²³ This seems to evoke a potentiality that is, then, associated with the living processes described.

Informatics, to some extent, can be regarded as the original 'methodology' of the exercise of power over life because such power has always relied on the generation, accumulation, and processing of knowledge regarding living processes.²⁴ However, the increased possibility of knowing and controlling living processes through technologies that enable their isolation, combination, and manipulation is said to give rise to a new form of 'biopower' or 'biopolitics'.²⁵

Although it is not entirely clear what this new incarnation of biopower would consist of, or what its consequences would be, the most commonly held view seems to be that informatics not only facilitates but intensifies the exercise of power over life. As Kay suggests: 'genetic information signifie[s] an emergent form of 'biopower': the material control of life would now be supplemented by the promise of controlling its form and logos, its information'.²⁶

However, the suggestion that a new sort of 'biopower' has emerged can itself be questioned in various ways. For example, the concept of information was - arguably - not the first to hold out the promise of the possibility of knowing and controlling living processes. Other (and earlier) notions signifying biological specificity, such as organization, to some extent held out the same promise (see para. 2.2.3 below).²⁷ Moreover, although bioinformatics is often represented as somehow disrupting biological processes in an effort to maximize the movement of 'bits' of information, genetic information 'may itself not be behaving in a predictable generation-to-generation way'.²⁸ In other words, informatics - and technology generally - does not

²³ Pottage (2006), pp. 140 and 143.

²⁴ Thacker (2005), p. 25.

²⁵ Kay (2000), p. xvi and p. 3; Helmreich (2003), p. 341 and p. 352.

²⁶ Kay (2000), p. 3; I argue (Chapter 6, para. 2.2.3) that the understanding of biopower as power 'over' life is mistaken.

²⁷ Ibid., p. 47.

²⁸ Helmreich (2003), p. 343.

exclusively intervene, manipulate, and control but also facilitates the visualization and representation of living processes and how they function.²⁹

1.2 The different forms of Aristotelian form

1.2.1 Aristotle's idea of form

The notion of information as it was used in the life sciences in the latter half of the twentieth century is often regarded as a reinterpretation of Aristotle's idea of form. 'Form' has always been a complex and historically varying notion with different implications in relation to the organic and inorganic.³⁰ The notion itself is often used to determine this very distinction. Aristotle elaborated his idea of a material form in reaction to two competing ideas: those of the philosophers who solely focused on matter and ignored the role of form altogether, and - more importantly - Plato's ideas on the distinction between form and matter.³¹

Plato introduced a separation between ideal or transcendent forms ('Ideas') and the material world. I shall not discuss Plato's philosophy here. It suffices to say that Aristotle thought it impossible that the material world was a reflection of, or was shaped by, ideal forms while such forms were themselves regarded as 'unchanging and at rest, in a transcendent world remote from the world of sense and hence unable to affect it'.³² He observed that 'it would seem to be impossible that the substance should exist apart from that of which it is the substance; so how would the Forms, being the substances of things, exist apart from them?'³³

It should be pointed out that Aristotle, perhaps confusingly, regarded form as substance.³⁴ There is a significant difference between substance and matter in Aristotelian philosophy. Simply put: matter is that of which things are made up, while

²⁹ Ibid., p. 345.

³⁰ Emerton (1984), p. 13, refers to a 'flux of form'; Emerton does not address organic form specifically.

³¹ Ibid., p. 49.

³² Ibid.

³³ Aristotle (1998), pp. 34-35: Book Alpha [991b].

³⁴ Aristotle (1986), p. 131: although the association of substance with form may seem counterintuitive today, H. Lawson-Tancred (translator) notes that Aristotle's predecessors and contemporaries generally held such a 'materialist-substantialist' view.

substance is the specific organization (or form) that makes something into what it is.³⁵ Aristotle's idea of form as substance has led to considerable criticism from those who regard such an idea as an impossible conundrum. Descartes, for example, did not seem to think much of this particular idea of form:

[F]or the schoolman the true reality is neither form nor matter, but the physical composite born of form and matter, which alone deserves the name of substance ... The scholastic conception of a distinct notion not corresponding to any separate reality has no meaning for Cartesianism, and this is why Descartes always criticizes substantial forms as if forms were substances ... Scholastic substantial form translated into Cartesian thought is not merely a complementary principle ... but an immaterial substance. It is hardly surprising that Descartes ... felt horror ... for such a monster.³⁶

Although Aristotle seemingly sustained Plato's dualism between form and matter by distinguishing the two notions, his alternative was in fact much more complex. He rejected Plato's suggestion that the form has an ideal quality and instead introduced form 'into' matter. However, this does not mean that form is an inherent pattern in matter. Rather, form and matter are no longer considered as two entirely different states or manifestations of an entity. They are regarded as cooperating notions that together signify a process of formation. This not only means that form becomes a changing and dynamic principle rather than an unchanging pattern or an ideal form, but that matter is no longer regarded as a passive substance on which a certain form is imposed. As Bensaude-Vincent observes:

Instead of being exterior, transcendent or primary, the principle of intelligibility (*archē*) is incorporated in nature, immanent ... The tradition that has emptied matter of its purposes in order to transfer all information to the exterior is so strong that we tend to think of substance as passive, like a base or a limit. Well, what we can rediscover with Aristotle is precisely a remarkable attempt to make matter dynamic, in the precise sense of the Greek term *dunamis*, that is to say 'puissance'.³⁷

This aspect of Aristotle's thought often goes unrecognized; it is assumed that he proposed a rigid distinction between form and matter where the former was regarded as being imposed on the latter.³⁸ However, whereas Plato's philosophy is characterized by the dualism of an Idea and its material reflection or manifestation, Aristotle thought in terms of a process of formation that disables this dualism.³⁹ Form and matter can no

³⁵ Aristotle (1998), p. 240: Book Eta 3 [1043b].

³⁶ Emerton (1984), p. 127, citing E. Gilson.

³⁷ Bensaude-Vincent (1998), p. 80 (my translation).

³⁸ Simondon (1964) criticizes the 'hylomorphic' model of Aristotle; Deleuze & Guattari (1999), pp. 408 and 411 refer to a 'a life proper to matter' or a 'material vitalism' without recognizing that it was Aristotle himself who 'vitalized' matter.

³⁹ Bensaude-Vincent (1998), p. 263.

longer be easily distinguished because they both represent stages in a temporal process of the translation of potentiality into actuality.⁴⁰

Emerton observes how Aristotle, 'by ... drawing together various strands of meaning - substance, causality, teleology, actuality and potentiality, logical definition - ... made the concept of form into a powerful, flexible, and universally applicable explanatory tool'.⁴¹ Aristotle himself deployed form in different ways and described it in various terms.⁴² Of these various meanings the most essential is - arguably - that of a process of generation and translation of potentiality.

1.2.2 Form as an active principle

Aristotle believed that 'form ... is a kind of power immersed in matter'.⁴³ The idea of 'power' is understood here as '*puissance*': an as yet unrealized or unactualized potential rather than the traditional idea of power as sovereign and authoritative ('*pouvoir*').⁴⁴ It is this idea of form as potential or as a productive force that perhaps inspired Nietzsche's idea of life as 'will to power' and, subsequently, Canguilhem's idea of 'vital normativity' and Foucault's idea of 'biopower' (see Chapter 6).

In his later work, Aristotle associated his alternative to Plato's idea of form with the notion of the 'soul'. He described the soul as form but not a form that is separate from, or preformed in, matter. Rather, he observed that 'change and growth too are in virtue of the soul'.⁴⁵ One of the faculties of the soul is its 'motivating capacity'; the way in which it produces movement. This is attributed to '*orexis*', often translated as 'desire' but understood differently from today's common sense notion of the term.⁴⁶ The soul, therefore, represents a much more active principle than Plato's idea of form. However, Emerton observes how Aristotle's association of form with the 'soul' probably gave rise to the misunderstanding that form was elevated over matter, thereby bringing Aristotle's

⁴⁰ Aristotle (1998), p. 250: Book Eta 6 [1045b]: 'the last matter and the shape-form are the same thing and a unity, the one potentiality the other in actuality'.

⁴¹ Emerton (1984), p. 63.

⁴² Ibid., p. 48.

⁴³ Ibid., p. 50.

⁴⁴ Lash (2006), p. 324.

⁴⁵ Aristotle (1986), Book II para. 415b, p. 166.

⁴⁶ Ibid., p. 211 (translator's note).

thought closer to that of Plato.⁴⁷ Aristotle's notion of form has traditionally become associated with purposiveness and teleology.⁴⁸

Aristotle's idea of form is one of the four 'causes' that he described and, arguably, the one that has been most influential in the life sciences. Heidegger notes that these four causes together signify a 'bringing-forth' or a process of '*poiesis*'.⁴⁹ Bensaude-Vincent observes that it is Aristotle's four causes *together* that are relevant to the modern notion of information, rather than merely the formal cause understood as an imposition of form on matter:

[I]f Aristotle's *Physique* has any pertinence today, is it not because it distinguishes several notions that together vaguely recover the concept of 'information'? This term appeals to us because it corresponds at the same time to the form that can be defined by its contours (*eidos*), to the form that results from a process of production (*morphē*), to a '*puissance*' or a seed, or in general to an agent or even to an adaptation to a certain usage that Aristotle calls *telos*, end. In short, information is much more than the imposition of a form; in a way, it deploys the four causes.⁵⁰

If information is identified with a form that is predominantly characterized through its distinction from matter, rather than through the role it plays in a process of 'bringing-forth', then its potential remains limited. More importantly, Aristotle himself did not separate form from matter or elevate one above the other. Such a separation was subsequently read into his work by commentators, either for theological reasons or because Aristotle's own association of form with the soul seemed to suggest such a distinction.⁵¹ However, Aristotle's concern was precisely to challenge the distinction between form and matter introduced by Plato.

Although Aristotle's form is usually represented as a singular idea, Bensaude-Vincent observes how it provides us with different concepts - or with a 'toolbox' of concepts - that allow us to think beyond the form/matter distinction:

[B]y substituting a regime of dichotomies by a regime of the pluralism of causes and modalities, by supposing a 'close to being' between being and nothingness, by emphasizing the reality of the virtual, Aristotle has provided us with a set of concepts, a toolbox, to liberate ourselves from the

⁴⁷ Emerton (1984), p. 57.

⁴⁸ See para. 2.2.2 below and Chapter 2, para. 2.1.1, on Kant's idea of a 'purposiveness without purpose' as an alternative to traditional teleology; Zuckert (2007), p. 15.

⁴⁹ Heidegger (1977), p. 10.

⁵⁰ Bensaude-Vincent (1998), pp. 262-263 (my translation).

⁵¹ Emerton (1984), p. 57.

'savage logics' that would seek to explain all of nature and technology with the help of only two concepts, matter and form.⁵²

It is undoubtedly the deceptive simplicity of the concept of form, together with its - less apparent - richness and diversity that makes it such an influential concept. Although Aristotle's notion of form has often been criticized or dismissed, it has remained highly influential.⁵³

1.2.3 Buffon's 'moule intérieur'

The modern notion of information was not the first influential reincarnation of Aristotle's idea of form. Buffon elaborated, in his '*Histoire naturelle générale et particulière*' of 1749, the concept of the '*moule intérieur*'. He explained this idea as follows:

[T]he body of an animal is a sort of internal mould ('*moule intérieur*'), in which the matter that contributes to its growth forms and assimilates itself to the whole ... It therefore seems certain to us that the body of the animal or plant is an internal mould that has a constant form but whose mass and volume can augment proportionally. That the growth or, if you like, the development of the animal or plant is only realized through the extension of this mould in all its exterior and interior dimensions; that such extension is realized through the introduction of a secondary and external matter which penetrates into the interior, which becomes similar to the form and identical to the matter of the mould.⁵⁴

Although this 'internal mould' seemed to represent a sort of 'plastic' form - as Lamarck, and later Nietzsche, would say -⁵⁵ that shaped matter from within, Buffon in fact regarded the 'mould' as a Newtonian force of attraction 'similar to those that accounted for the formation of crystals and chemical bonding'.⁵⁶ The idea of the 'mould' functioned in conjunction with another concept: that of the 'organic molecules' ('*molécules organiques*'). Buffon regarded the latter as the material elements out of which all living processes are made up. He regarded these elements as being organized

⁵² Bensaude-Vincent (1998), p. 261 (my translation).

⁵³ Ibid., p. 73; Emerton (1984), pp. 60-61.

⁵⁴ Canguilhem (2003), p. 67, citing Buffon (my translation).

⁵⁵ Nietzsche (1983), p. 62: 'I mean by plastic power the capacity to develop out of oneself in one's own way, to transform and incorporate into oneself what is past and foreign, to heal wounds, to replace what has been lost, to recreate broken moulds'; Deleuze (1983), p. 42: 'Nietzsche criticizes Darwin for interpreting evolution and chance within evolution in an entirely reactive way. He admires Lamarck because Lamarck foretold the existence of a truly active *plastic force*, primary in relation to adaptations: a force of metamorphosis.'

⁵⁶ Sloan (2002), p. 234.

or structured through the 'action' of the 'internal mould'.⁵⁷ It was the 'mould' as a force of attraction that gathered the 'organic molecules' and made them obey to 'a kind of law of morphological constancy', as Canguilhem observes.⁵⁸

Buffon's idea of an internal form or 'mould' was primarily meant to account for morphological individuality; as Canguilhem says, to 'explain that a specific form persists through this incessant whirlwind that is life'.⁵⁹ However, Buffon did not regard the 'mould' as limiting living processes to a certain kind of form. Rather, the 'mould' - understood as an active principle or Newtonian force - enabled the generation of a variety of different individual forms. As Buffon observed, 'with this single resource and subject, nature can vary its works to infinity'.⁶⁰ Canguilhem deduces from Buffon's statement that the individual form is only a product or consequence rather than a principle:

[N]ature is brought back to the identity of an element - 'one single resource and subject' - whose coherence with itself produces the appearance of diversity - 'nature can vary its works to infinity'. The life of an individual, animal or plant, is therefore a consequence and not a principle, a product and not an essence.⁶¹

Buffon attributed almost every biological process imaginable to the interaction between his two concepts of the 'mould' and the 'molecules'. Together these concepts explained - according to him - organization, growth, 'and the perpetuation of the species through time by means of the self-replicating powers of the *moule*'.⁶²

The influence of Buffon's concept of the '*moule intérieur*' is evidenced by references to it by Kant⁶³ and by the inspiration it provided, according to Canguilhem, for some of the concepts and terms used by Claude Bernard. According to Canguilhem, the 'internal mould' functioned as 'a logic intermediary' between the Aristotelian idea of form and Bernard's '*idée directrice*'.⁶⁴ He believed that some of Bernard's concepts could, in turn, be regarded as preceding the modern notion of information:

⁵⁷ Ibid.

⁵⁸ Canguilhem (2003), p. 67 (my translation).

⁵⁹ Canguilhem (2002), p. 357 (my translation); see also Canguilhem (2003), p. 72.

⁶⁰ Canguilhem (2003), p. 69, citing Buffon. (my translation).

⁶¹ Ibid., p. 70 (my translation).

⁶² Sloan (2002), p. 234.

⁶³ Ibid., p. 237: Kant said '[t]he internal molds [*innerlich Formen*] of Herr Buffon ... according to the opinion of Herr Maupertuis, are either as unintelligible as the thing [*Sache*] itself, or imagined as entirely arbitrary'.

⁶⁴ Canguilhem (2003), p. 67 (my translation).

[I]f genetic information can define the code of protein synthesis, then we can argue that Bernard's terms of '*consigne*', '*idée directrice*', '*dessin vital*', '*préordonnance vitale*', '*plan vitale*', '*sens des phénomènes*', are just so many attempts to designate - by a convergence of metaphors - an advanced biological fact, in a way before it was discovered.⁶⁵

Although Canguilhem loosely traced this path from Aristotle's idea of form through Buffon's concept of the '*moule intérieur*' and Bernard's idea of a '*plan vitale*' to the modern notion of information, he believed that it was impossible to equate modern concepts with previously elaborated ones. This is because concepts are particular to the historical period in which they arise and to the problem that they envelop (see Chapter 1, para. 2.1.3). However, this does not preclude that some concepts are 'theoretically polyvalent'.⁶⁶ Moreover, although concepts cannot be equated there may still be an affinity between ideas, even if such ideas were elaborated in different times and under different circumstances.

PART II

2.1 Two lines of inquiry

2.1.1 Information as metaphor

Much has been written on the role of analogy and metaphor in the life sciences in general and, more specifically, on the notion of information as metaphor.⁶⁷ The role of information as one of the organizing principles of the life sciences in the latter half of the twentieth century⁶⁸ can be understood from the following observation by Jacob:

[H]eredity is described today in terms of information, messages and code ... What are transmitted from generation to generation are the 'instructions' specifying the molecular structures: the architectural plans of the future organism. They are also the means of executing these plans and of coordinating the activities of the system ... The organism thus becomes the realization of a programme prescribed by its heredity. The intention of a psyche has been replaced by the translation of a message. The living being does indeed represent the execution of a plan, but not one conceived in any mind. It strives towards a goal, but not one chosen by any

⁶⁵ Bernard (1966), pp. 12-13 (Preface by Canguilhem, my translation). Canguilhem points out that Bernard used concepts that were informed by a 'psychological' notion of information in order to describe processes that are now addressed by reference to a 'physical' concept of information.

⁶⁶ Canguilhem (1977), p. 6.

⁶⁷ See, e.g., Fox Keller (1995) and (2002); Kay (2000).

⁶⁸ Rheinberger & Gaudillière (2004), p. 1.

will. The aim is to prepare an identical programme for the following generations. The aim is to reproduce.⁶⁹

This captures the generalized sense of information as something that is transmitted through generations and represents or contains the prerequisites for the formation of an organism. The question is whether information should be regarded as a metaphor or whether it should be 'taken literally', in the sense that hereditary material is regarded as carrying information. Information would, then, be regarded in a semantic sense as being associated with meaning.⁷⁰

The contrary view is that information can only be a metaphor. The notion of 'information' is thought to be used solely in order to render the workings of 'nature' understandable by imposing a certain model on a process to which that model is perhaps analogous, but not literally applicable. The debate then turns to the question of whether this particular metaphor is productive or not. It has been argued that information as metaphor is not particularly suited to the task, because it does not clearly refer to - or correspond with - anything; it has been called a 'metaphor of a metaphor and thus a signifier without a referent'.⁷¹

While its popularity and use spread rapidly, it was never entirely clear what the term 'genetic information' precisely referred to. Such information was understood to be located in - or carried by - genetic material. This material was regarded as somehow embodying 'meaningful' instructions for protein coding, so that it was possible for these instructions to be 'misunderstood' (resulting in 'unintended' consequences such as mutations that cause hereditary disease).⁷²

Such use of the notion of information introduced a distinction between genetic material and environment. Whereas the former was regarded as either containing or producing 'information', the latter was regarded as receiving or expressing it.⁷³ Moreover, the idea of genetic information gave rise to the thought that 'causal power and information are carried in the DNA, and living things are created by an *outward flow* of causality and

⁶⁹ Jacob (1976), pp. 1-2.

⁷⁰ Griffiths (2001), p. 397.

⁷¹ Kay (2000), p. 2.

⁷² Canguilhem (1978), p. 172, observes: 'there is no interpretation which does not involve a possible mistake'.

⁷³ Griffiths (2001), p. 406.

form from the nucleus',⁷⁴ thereby assuming the importance of a specific centre of reference.

These distinctions were subsequently challenged by assertions that '[a]ny defensible definition of information in developmental biology is equally applicable to genetic and non-genetic causal factors in development'.⁷⁵ However, although the notion of information was now used in equal measure with regard to hereditary material and environment, the idea of a non-genetic information 'remain[ed] underspecified'.⁷⁶ It gave rise to the impression that information was something to be acquired from the environment by an organism.

Varela, one of the founders of autopoietic theory, argues that the idea of information as something that exists 'in' the environment is unproductive. Rather, information emerges from the process of differentiation between organism and environment.⁷⁷ Oyama, with reference to Bateson, also points out that information can be regarded as 'a difference that makes a difference'.⁷⁸ She observes: 'Developmental interactants are "informational" not by "carrying" context-independent messages about phenotypes, but by having an impact on ontogenetic processes - by making a difference.'⁷⁹

The confusion over the character of the modern notion of 'information', and over what it refers to as a metaphor, can be partly attributed to its complicated relation to meaning. As Kay points out, in the mathematical theory of communication information was regarded as relating to a process of selection rather than as an ontological entity that could be communicated or as something that was semantically meaningful. However, the significance of this concept of information could partly be attributed to the way in which it capitalized on the common sense understanding of information:

[I]nformation theory metaphorizes the conventional notion of information by borrowing the semiotics of human language to describe highly technical, restrictive, and nonhuman processes ... The notions of information, its storage and transfer, conjured compelling and deceptively accessible imagery of communications that swiftly reshaped scientific and popular representations of nature and society.⁸⁰

⁷⁴ Oyama (2000), p. 47.

⁷⁵ Griffiths (2001), p. 396.

⁷⁶ Oyama (2000), p. 194.

⁷⁷ Varela (1991), p. 87.

⁷⁸ Oyama (2000), p. 67, referring to Bateson (2000), p. 318.

⁷⁹ Oyama (2000), p. 67.

⁸⁰ Kay (2000), p. 21.

While the difference between its technical and semantic use may complicate the character of the concept of 'information', it is undoubtedly also this ambiguity that makes the notion so productive.

Depending on one's view of how a metaphor functions, the concept of information can be regarded as a mere figure of speech or as a theoretical concept in itself.⁸¹ According to Canguilhem, what is distinctive about models and analogies - and, arguably, also about metaphors - is how they function by losing their specificity and by giving rise to a new object of understanding: 'A model only reveals its productivity in its own impoverishment. It must lose its specific originality in order to enter into a new generality together with that to which it corresponds.'⁸²

In other words, information should not be regarded as a notion that is directly applicable to a biological entity or process. Rather, the use of information as metaphor gives rise to a new idea that cannot be equated with either a biological process or with the traditional understanding of information. Canguilhem observes that 'we could say that the model prophesizes',⁸³ meaning that a model or metaphor 'points beyond itself'⁸⁴ to interpretations that were not previously imagined or even considered. It does so not by corresponding to the object or process that it refers to but through a kind of lateral engagement with it. Canguilhem observes:

[A] good hypothesis is not always the one that rapidly leads to its own confirmation, that makes it possible to apply the description of a phenomena to an explanatory schema during the first attempt. It is the one that obliges the researcher, because of an unforeseen discordance between explanation and description, to either correct the description or to re-structure the explanatory schema. Can we not similarly say that, in biology, the models that have a chance to become the best ones are those that slow down our latent precipitation to assimilate the organic to its model?⁸⁵

The notion of information is productive not because it is an adequate metaphor but because of the difficulty of direct correspondence; because it 'slows us down' and makes us think.

⁸¹ Griffiths (2001), p. 395, citing Sarkar: 'It is little more than a metaphor that masquerades as a theoretical concept'.

⁸² Canguilhem (2002), p. 313 (my translation).

⁸³ Ibid, p. 316 (my translation).

⁸⁴ Pottage (2006), p. 139: used in relation to 'laterality'.

⁸⁵ Canguilhem (2002), p. 315 (my translation).

It is probably precisely because of the difficulty of correspondence that the notion of genetic information has ‘served as a discursive link between these two previously distant fields [of molecular genetics and biochemistry]’⁸⁶ and as an ‘interdisciplinary and cultural medium of exchange’.⁸⁷ Canguilhem observes, with regard to the ‘discovery’ of DNA, that different disciplines not only communicate with each other with regard to a certain object of study but that an object of study actually emerges *through* such communication between disciplines.⁸⁸ Although the notion of information was initially regarded as mere metaphor or analogy, it subsequently turned into an object of study in its own right.

This seems to indicate that what is at issue is not so much the productivity of a single metaphor or entity, but a process of translation. As Pottage observes: “‘Information’ is the same and yet always different.”⁸⁹ Rheinberger suggests that representation necessarily involves a series of translations,⁹⁰ referring to Latour who observes how an object of inquiry is kept ‘constant’, perhaps paradoxically, through a series of translations and transformations:

[A]cts of reference are all the more assured since they rely not so much on resemblance as on a regulated series of transformations, transmutations, and translations. A thing can remain more durable and be transported farther and more quickly if it continues to undergo transformations at each stage of this long cascade. It seems that reference is not simply the act of pointing or a way of keeping, on the outside, some material guarantee for the truth of a statement; rather it is our way of keeping something *constant* through a series of transformations ... What a beautiful move, apparently sacrificing resemblance at each stage only to settle again on the same meaning, which remains intact through sets of rapid transformations.⁹¹

Not speaking specifically about the notion of information, Latour notes how ‘transfers of *information* never occur except through subtle and multiple *transformations*’.⁹² Perhaps the notion of information has remained ‘constant’ and has been so effective in stimulating communication between disciplines because it is such a ‘translatable’ notion. The question that arises, and that is rarely addressed, is: what changes does the notion of information undergo in these processes of translation? Here, the focus is

⁸⁶ Kay (2000), p. 3.

⁸⁷ *Ibid.*, p. 29.

⁸⁸ Canguilhem (1988), p. 117: it concerns the constitution of ‘a “new scientific object,” what I might call a “polyscientific” or “interscientific” object, by which I mean not an object treated by more than one discipline but one constructed as the explicit result of collaboration among several disciplines’.

⁸⁹ Pottage (2006), p. 156.

⁹⁰ Rheinberger (1997a), p. 102.

⁹¹ Latour (1999), p. 58.

⁹² *Ibid.*, p. 298.

mainly on the slippage between a certain interpretation of Aristotle's form and the modern notion of information.

2.1.2 *Form abstracted from matter*

Kant believed that the distinction between form and matter organizes all thinking: 'These two concepts underlie all other reflection, so inseparably are they bound up with all employment of the understanding. The one (matter) signifies the determinable in general, the other (form) its determination.'⁹³ In fact, Kant's theory of understanding was organized by reference to this distinction: *a priori* forms and empirical matter.⁹⁴ Perhaps it is, therefore, unavoidable that the notion of information in relation to living processes has also been determined by this distinction. Information has been represented, at least to a certain extent, as being theoretically opposed to the notion of material environment or embodiment.⁹⁵

The relation between matter and information is usually envisaged on the basis of a seemingly irreparable divorce. Information is regarded as the end product of a progressive process of abstraction that continuously refers to an original state where no such abstraction has yet taken place. Genetic information is described as almost entirely distinguished from the matter from which it is thought to be derived or in which it is 'embodied'. Information is regarded as something that exists prior to, and separate from, its expression or instantiation.⁹⁶ The focus then shifts to the ways in which this information can be accessed and transported.

Living processes - in their 'informational forms' - are regarded as 'free from material constraints, without particular instantiation [they are] free to travel across time and space'. Once abstracted from matter, they are regarded as 'highly mobile'.⁹⁷ The significance of matter is recognised only to the extent that the information derived from it necessarily refers back to the material substrate in order to produce knowledge. Some have described the effects on living processes of their material environments, such as -

⁹³ Emerton (1984), p. 20, citing Kant.

⁹⁴ Gutting (2005b), p. 5.

⁹⁵ See, e.g., Parry (2004a); Hayles (1999); Thacker (2005).

⁹⁶ Oyama (1985), p. 12; Hayles (1999), p. 13, notes how the idea of 'disembodied information becomes the ultimate Platonic Form'.

⁹⁷ Parry (2004), p. xix.

for example - the computer.⁹⁸ However, even if the materiality of a particular technological medium is recognized, the representation of information as abstracted from matter is itself not questioned.

The distinction between form and matter necessarily leads to a focus on the manner in which transition from one state to another takes place. Such transition is usually regarded as progressive and as moving from one clearly defined stage (material) to another (immaterial).⁹⁹ New technologies are regarded as playing a role in this transition by “stripping down” these commodities or resources to what might be thought of as their bare informational essentials’.¹⁰⁰ However, the impossibility of tracing this process of abstraction and distinguishing the material or informational state in any meaningful way leads to confusion over what the notion of information itself represents.¹⁰¹

The idea of information as disembodied was reinforced in Shannon’s mathematical theory of communication and Wiener’s cybernetic theory. Their representation of information as distinguished from matter perpetuated the idea of ‘a kind of bodiless fluid that could flow between different substrates without loss of meaning or form’.¹⁰² Whereas the individual form had previously been identified through the ‘identity of matter’, Wiener believed that the individual was now represented through a ‘continuity of pattern’. It was, he suggested, the ‘memory of the form that is perpetuated during cell division and genetic transmission’.¹⁰³

The distinction between form and matter is not necessarily unproductive; reference has - for example - been made to the productivity of a ‘dialectic of materiality’.¹⁰⁴ In fact, critics of this distinction tend to rely on the same dualistic scheme. Rather than privileging form, the importance of - a sometimes reconceptualized - matter is often emphasized.¹⁰⁵ It is argued that privileging form over matter disregards the many ways in which matter gives rise to information and gives it its meaning.¹⁰⁶ The idea that the

⁹⁸ Hayles (2005); Thacker (2004).

⁹⁹ Parry (2004), pp. 65-66.

¹⁰⁰ Ibid., p. xviii.

¹⁰¹ Ibid., pp. 65-66.

¹⁰² Hayles (1999), p. xi.

¹⁰³ Kay (2000), p. 89.

¹⁰⁴ Sunder Rajan (2006), p. 15.

¹⁰⁵ See Lloyd (1996) for a feminist critique of the form/matter distinction; Hayles (2005), pp. 2-3, argues for a different conception of materiality as ‘an emergent property created through dynamic interactions between physical characteristics and signifying strategies’; Oyama (1985), p. 22.

¹⁰⁶ See, e.g., Hayles (2005), p. 210.

twentieth century was characterized by ‘dematerialization’ has also been disputed: the transition from a material to an informational world is not so much a real consequence of technology as a ‘normative imperative’ of innovation.¹⁰⁷ The emphasis on the notion of information in relation to living processes has been regarded as a way to facilitate the commodification of such processes.¹⁰⁸

In conclusion, it can be argued that most references to information in the life sciences rely on the distinction between form and matter. Information is usually associated with Aristotle’s idea of form. However, that original idea was not characterized by the form/matter distinction. In fact, Aristotle elaborated it to challenge that distinction. By associating or identifying the modern notion of information with a superficial understanding of Aristotle’s form, the multifaceted nature and productive character of the latter is lost. As a consequence, the notion of information remains conceptually simplistic and its productivity as a concept becomes questionable.

2.2 From form to information

2.2.1 *Form as information*

How has form become associated with information and what has it come to signify? Information has come to be regarded by many as the ‘modern agent’ of form.¹⁰⁹ Kay provides a good illustration of how information has been associated with Aristotle’s idea of form. When Delbrück accepted the Nobel Prize, he said that it was Aristotle who first discovered DNA. According to him, Aristotle first developed the idea of a form ‘stored’ in matter that ‘acts, creates form and development, and is not changed in the process’.¹¹⁰ Delbrück likened DNA to Aristotle’s idea of the soul as the principle of movement that itself remains unchanged: ‘genetic information, qua DNA, was both the origin and universal agent of all life (proteins) - the Aristotelian prime mover’.¹¹¹

¹⁰⁷ Bensaude (1998), pp. 27 and 249.

¹⁰⁸ Sunder Rajan (2006), p. 16.

¹⁰⁹ Oyama (1985), p. 27.

¹¹⁰ Kay (2000), p. 38, citing Delbrück.

¹¹¹ Ibid., p. 30.

Form is presented here as a persistent pattern that is transmitted through generations. When information is regarded as form in this way, the probable result is a kind of modern preformationism. As Oyama observes:

[W]hat is central to preformationist thought is not the literal presence of fully formed creatures in germ cells, but rather a way of thinking about development - development as *revelation* of preformed essence rather than as contingent series of constructive interactions, transformations, and emergences. It is a way of thinking that makes real development irrelevant because the basic 'information', or form, is there from the beginning, a legacy from our ancestors.¹¹²

The identification of information with an interpretation of Aristotelian form as an unchanging pattern disregards the way in which Aristotle's form formed part of a process of generation and actualization of potentiality. Oyama observes:

[F]orm emerges in successive interactions. Far from being imposed on matter by some agent, it is a function of the reactivity of matter at many hierarchical levels, and of the responsiveness of those interactions to each other.¹¹³

Oyama's statement is meant as a critique of the traditional notion of form. Her own description of form is surprisingly close to Aristotle's original idea. It is not so much the identification of the modern notion of information with Aristotle's form that is the problem; it is the misinterpretation of Aristotle's form as an imposition on matter. His original idea of form complements, rather than clashes with, the description of development as a contingent and material process of emergence.

2.2.2 *Form without purpose*

Aristotle's idea of form is often regarded as teleological in the sense that it represents that which causes an organism to become what it - potentially - is. The modern notion of information is usually associated with this teleological idea of form. It is regarded as a form or pattern that is inherent in matter, transferred across generations, and that causes an organism to develop in a certain way. The idea of teleology in relation to living processes is usually identified with a notion of purpose that has taken many different forms over the years.

¹¹² Oyama (2000), p. 136; see also Oyama (1985), p. 2.

¹¹³ Oyama (1985), p. 22.

Foucault describes how, in the eighteenth century, living beings were divided into categories of species and genera. What defined this period was the reliance on continuity, order, and a kind of formalism in relation to living processes rather than a notion of purpose or finality.¹¹⁴ It could be argued that the identification of the modern notion of information with Aristotelian form signifies a return to the association of living processes with purpose. If information signifies a return to purpose then the question is: what kind of purpose?

Rather than associating purpose with the traditional teleological notion of form, it can also be regarded as signifying a process that lacks a predetermined end. Information has, for example, been regarded as a process of ‘in-forming’.¹¹⁵ However, rather than regarding such a process as indicative of a vital or teleological force, it can be regarded as a process of self-generation. This could be explained with reference to the idea of ‘purposiveness without purpose’ (see Chapter 2, para. 2.1.1) that Kant proposed in order to question the productivity of traditional teleology as a way of understanding the organization of living processes.

Kant believed that it was mistaken to attribute teleology or a purpose to nature. For him, living processes represented first and foremost a problem for knowledge that could be addressed through his paradoxical idea of a purposiveness that lacked purpose. An organism could only be regarded as a process that included its own cause and effect and did not have a predetermined purpose.¹¹⁶ This meant that a purpose could be attributed to it by a subject who seeks to understand the organism.

Aristotle’s idea of form may actually be more similar to Kant’s ideas than one would expect. An organism can be identified with the principle of its own organization or formation, at least for the purpose of understanding it. This principle, or ‘form’ as Aristotle called it, represents a process of self-generation or actualization of potentiality that is not predetermined. Canguilhem describes such an idea of non-teleological purpose as a ‘possible, operative finality’ rather than ontological finality (see para. 3.1.1 below).¹¹⁷ This means that purpose does not function as a principle of formation with a

¹¹⁴ Foucault (2004), p. 160.

¹¹⁵ Oyama (1985), p. 12.

¹¹⁶ Kant (1987), p. 249, section 64, para. 370.

¹¹⁷ Canguilhem (1978), p. 175.

certain goal or end, but that generation comes about through the difference between what an organism is and what it can be.

The idea that an organism or system represents its own purpose was taken up again in the twentieth century by cybernetics and autopoietic theory. Wiener, Bigelow, and Rosenblueth proposed a new idea of purpose or teleology that was ‘equally applicable to living organisms and machines’; the idea of purpose was now included in a ‘uniform behavioristic analysis’.¹¹⁸ Although this notion seemingly resembled traditional teleology because it regarded purpose as the central organizing feature of systems,¹¹⁹ this ‘definition of purposefulness that was built purely on the culmination of a sequence of events’¹²⁰ was - at least for some critics - ‘both so all-encompassing as to rule out nothing and so devoid of content that it had no overlap with any common meaning of the term.’¹²¹

In autopoietic theory purpose is represented as ‘purposeless’, as in Kant’s work. This means that purpose is not attributed to living processes or the process of autopoiesis itself but forms part of the domain of the observer who describes the living system and seeks to understand it (see Chapter 3, para. 3.1.1). Nevertheless, the cybernetic understanding of purpose is recovered in the description of the self-generative character of systems.

2.2.3 *Form as organization*

Kay describes how, although the idea of information already existed for a long time in relation to intelligence and education, it was only in the twentieth century that information came to be divorced from meaning. It came ‘to signify purely syntactic arrangements of symbols (“logical instruction to select”) suited for electronic communications’ in Shannon’s mathematical theory of communication.¹²² It was only after the Second World War that information came to be regarded as a scientific concept

¹¹⁸ Galison (1994), p. 245.

¹¹⁹ Kay (2000), p. 81: ‘The term *servomechanisms*, or self-correcting negative feedback, came to designate machine – living or inanimate – with intrinsic purposeful behavior.’

¹²⁰ Galison (1994), p. 249.

¹²¹ Ibid.

¹²² Ibid., p. 20.

in itself.¹²³ Although the impression may be prevalent that the notion of information was introduced into the life sciences at the time of the ‘discovery’ of DNA, it was already used in research before that time.¹²⁴

According to Kay, before the introduction of information into the life sciences ‘what had been transferred across biological space and time earlier was biological and chemical specificity’.¹²⁵ She believes that information became a metaphor for specificity or that it somehow came to replace that notion.¹²⁶ However, biological specificity is itself a very general and vague notion. Much like information, it only obtained ‘a particular technical meaning, conceptual coherence, and material potency’ at the beginning of the twentieth century.¹²⁷

Although the notions of specificity and information perhaps fulfilled a similar role in the life sciences, the two notions cannot be identified. Not only because they emerged at different points in time, but because there is - as Kay argues - a ‘categorical difference between the two: specificity denoting material and structural properties; information denoting nonmaterial attributes, such as soul, potentialities, and form (telos), previously captured by the notion of organization and plan (logos)’.¹²⁸ Because of its similar connotation with immateriality, organization can also be regarded as a conceptual predecessor to the modern notion of information in the life sciences. The idea that living processes, at a certain moment in time, become characterized by their organization was also explored by Foucault who described it as the hidden characteristic that links all living processes and distinguishes them as such.¹²⁹

2.2.4 Information and individuation

The idea of information has not merely been regarded as a metaphor or an entity, but has also been associated with the emergence and organization of processes. Nevertheless, the notion of information hardly seems to play any role in autopoietic

¹²³ Ibid., p. 77.

¹²⁴ Ibid., p. 78.

¹²⁵ Ibid., p. 328.

¹²⁶ Ibid., pp. 2, 5 and 41-42.

¹²⁷ Ibid., p. 42.

¹²⁸ Ibid., p. 328; Kay, *ibid.*, p. 41, observes: ‘Specificity was the Aristotelian material cause ... Information was the Aristotelian form ... Specificity corresponded to body, information to soul.’

¹²⁹ Foucault (2004), p. 250.

theory; a theory that mainly focuses on the organization and individuation of living systems. It has been argued that

one could say either that information does not exist in this paradigm or that it has sunk so deeply into the system as to become indistinguishable from the organizational properties defining the system as such.¹³⁰

This suggestion is confirmed by Varela who observes:

[T]o assume in these fields that information is some *thing* that is transmitted, that symbols are *things* that can be taken at face value, or that purposes and goals are made clear by the systems themselves is all, it seems to me, nonsense ... Information, *sensu strictu*, does not exist. Nor do, by the way, the laws of nature.¹³¹

Varela refers to a particular interpretation of the notion of information as something that is transmitted and that represents an ontological entity. However, it could be argued that information becomes relevant when it is regarded as forming part of the process of the differentiation of systems. In other words, when it is regarded - as Bateson says - as 'a difference which makes a difference'.¹³² As Varela observes:

[A]lthough it is clear that we describe an X that perturbs from the organism's exteriority, X is not information. In fact, for the organism it only is a *that*, a *something*, a basic stuff to in-form from its own perspective. In physical terms there is stuff, but it is for nobody. Once there is body - even in this minimal form - it becomes in-formed for a self, in the reciprocal dialectics I have just explicated. Such in-formation is never a phantom signification or information bit, waiting to be harvested by a system. It is a presentation, an occasion for coupling, and it is in this *entre-deux* that signification arises.¹³³

Simondon did not develop his ideas on information in any detail but did attribute a significant role to it in relation to the process of individuation in biology.¹³⁴ He understood individuation as a temporal process of emergence of individual and environment (see Chapter 4, para. 4.1.1). Simondon emphasized that information should not be related to the distinction between form and matter. In fact, he made a point of criticizing the 'hylomorphism' - attributed to Aristotle - by saying that it only retains two extreme forms of a process. Information, according to him, is characterized by how it 'does not wish to become either form or matter'.¹³⁵ He believed that the significance

¹³⁰ Hayles (1999), p. 11.

¹³¹ Ibid., p. 155, citing Varela.

¹³² Oyama (2000), p. 67, referring to Bateson (2000), p. 318.

¹³³ Varela (1991), p. 87.

¹³⁴ Barthélémy (2005), p. 139, notes that Simondon does not show how his notion of information escapes the Aristotelian hylomorphism that he criticizes.

¹³⁵ Simondon (1964), p. 301 (my translation).

of information lies in the fact that it is a ‘requirement of individuation’; that which is necessary for the formation of an individual.¹³⁶ He observes that it represents ‘that through which a being conditions itself in a certain way’.¹³⁷

PART III

3.1 Canguilhem and information

3.1.1 *A return to Aristotelian form?*

Canguilhem observed in an essay, published in the *Revue de Métaphysique et de Morale*, that not many articles had been published in the *Revue* on the philosophy of biology. He sought to counter this apparent lack of interest and asked whether it had not been reasonable, rather than rational, at the beginning of the twentieth century to ‘resuscitate’ the Aristotelian concepts of ‘*puissance*’ and form by ‘reinventing them’.¹³⁸

His association of Aristotle’s idea of form with potential (*‘puissance’*) is significant. When the notions of form and information are characterized by reference to the form/matter distinction then it becomes difficult to distinguish any normative project in their use. How did Canguilhem understand the notion of information in the life sciences and how does his discussion of it reveal his own normative project?

Canguilhem addresses the notion of information in contemporary biology only in his later work.¹³⁹ Most commentators believe that he does not elaborate much on the significance of the notion or on how it affected his own previously elaborated concepts of individuality and normativity in the life sciences. Rather, he seems to impose an idea of form that he previously associated with the individual on the modern notion of information without considering the difference between these notions and without elaborating on the consequences of such a difference.¹⁴⁰

¹³⁶ Ibid., p. 15 (my translation).

¹³⁷ Ibid., p. 288 (my translation).

¹³⁸ Canguilhem (1947), p. 323 (my translation).

¹³⁹ Most notably Canguilhem (2002), pp. 358-364.

¹⁴⁰ Lecourt (1998), p. 223.

For example, he previously observed that the individual form was indivisible (see Chapter 4, para. 3.2.4)¹⁴¹ and later notes with regard to the notion of information in the life sciences that ‘it must not be forgotten that information theory cannot be broken down’.¹⁴² Lecourt takes this as proof that Canguilhem merely ‘transferred’ concepts. Canguilhem seems to regard the notion of information, understood as life’s ‘code’ or concept, as a vindication of his own ideas on the relation between knowledge and life. Lecourt argues:

[I]n his own way, Canguilhem is saluting, by simply transferring his concepts, the latest developments in the theory of genetic codes. They seem to have realized, in ways that seemed to him impossible, the project he outlined in 1943! Hence the strangely disabused but triumphant tone in which he demonstrates that the ‘concept’ is inscribed within ‘life’ in the form of a code.¹⁴³

Canguilhem observes: ‘To say that biological heredity is a communication of information is, in a way, to return to Aristotelianism if it is an admission that there is a *logos*, inscribed, conserved, and transmitted in the “*vivant*”.’¹⁴⁴ Lecourt deduces from this observation that Canguilhem equated the modern notion of information with Aristotelian form, understood as a pattern that is inherent in life. He summarizes his criticism of Canguilhem’s discussion on information as follows:

[I]nformation, with its discrete structure, replaces the signifying totality of form, but the signifying end can again be glimpsed in the primal signification. Ultimately, Canguilhem is celebrating Aristotle’s victory. Although the demands of ‘vitalism’ should have alerted him to this, the ontology with which he burdened it suddenly carries him away, and in his jubilation he forgets his own critique of Aristotelian biology. No doubt he attached too much importance to the formalist version of ‘code’ to which molecular biology almost surrendered in the mid-1960s.¹⁴⁵

It is certainly true that Canguilhem’s work is influenced by Aristotle; he recognizes this influence many times. However, Canguilhem does not regard information or form as a pattern that is somehow inherent in life’s processes. Nor does he regard information as a vital or teleological principle that ‘inform[s] the formless’.¹⁴⁶ Canguilhem, furthermore, observes that the idea of a final cause - as it is usually understood - is impossible with regard to living processes:

¹⁴¹ Canguilhem (2003), p. 78.

¹⁴² Canguilhem (1978), p. 172; Canguilhem (2006), p. 209: ‘*on ne doit pas oublier que la théorie de l’information ne se divise pas*’.

¹⁴³ Lecourt (1998), p. 223.

¹⁴⁴ Canguilhem (2002), p. 362 (my translation).

¹⁴⁵ Lecourt (1998), p. 223.

¹⁴⁶ Oyama (1985), p. 3.

[A]gainst finality one has always invoked life's failures, the disharmony of organisms, or the rivalry of living species, macroscopic or microscopic. But if these facts represent objections to a real, ontological finality, they run counter to arguments supporting a possible, operative finality. If there were a perfect, finished finality, a complete system of relations of organic agreement, the very concept of finality would have no meaning as a concept, as a plan and model for thinking about life, for the simple reason that there would be no grounds for thought, no grounds for thinking in the absence of all disparity between possible organization and real organization. The thought of finality expresses the limitation of life's finality. If this concept has a meaning, it is because it is the concept of a meaning, the concept of a possible, and thus not guaranteed, organization.¹⁴⁷

This means that Aristotle's idea of form as a teleological principle is necessarily limited and incomplete; otherwise the idea of teleology itself would have no purpose. If there was no difference between the possibility and the reality of an organism, then there would be no need for a concept of teleology. Its incompleteness, therefore, does not render teleology useless. In fact, it reveals the 'purpose of purpose': the original idea of a final cause was effective precisely because it signified possibility rather than preformation.

Canguilhem also observes how Aristotle's idea of a final cause is a highly technical and specialized principle that relies on the differentiation of functions within organisms. According to him, Aristotle could not have conceived of the high degree of pluripotency and indeterminacy that characterizes thought on generation and development in contemporary biology.¹⁴⁸

However, this does not mean that Aristotle's ideas have nothing to contribute to the contemporary life sciences. Canguilhem, for example, often refers to the idea that living processes represent at the same time 'formation of forms' and 'informed matter'.¹⁴⁹ The former indicates that life consists of continuous processes of formation and that it does not exist outside of such processes. In other words, life does not exist prior to - or apart from - its material instantiations.¹⁵⁰ The expression that life is 'informed matter' is a reference to Aristotle's idea that life is matter that cannot be understood through its composition or structure but only through its substance or form (understood as processes of formation).¹⁵¹

¹⁴⁷ Canguilhem (1978), p. 175.

¹⁴⁸ Canguilhem (2002), p. 322.

¹⁴⁹ Canguilhem (2003), p. 14 (my translation).

¹⁵⁰ Canguilhem (2002), p. 354.

¹⁵¹ Aristotle (1998), Book Eta 3, para. 1043b, pp. 240-241.

3.2 Information and 'knowledge of life'

3.2.1 *The problem of knowing life*

I argue that Canguilhem regards the notion of information in the life sciences as a productive idea through which to address the problem of knowing life. Foucault describes how the knowledge of life only became a question or problem at the beginning of the nineteenth century. Before that time, living processes were classified hierarchically and - although organisms were identified and differentiated - there was no real preoccupation with knowing the living *as* living.¹⁵² I have argued (see Chapter 2) that Kant formulated most clearly the idea that living processes represent a problem for understanding and that they are, in fact, characterized by this problematic relation to knowledge.

Canguilhem published a collection of essays entitled '*La connaissance de la vie*';¹⁵³ the problem of the knowledge of life informs all these essays. However, Canguilhem directly addresses the relation between knowledge and life - or between concept and life - in another essay entitled '*Le concept et la vie*'.¹⁵⁴ He asks the question:

[D]o we proceed, in the knowledge of life, from intelligence to life or do we rather move from life to intelligence? In the first case, how does intelligence find life? In the second case, how can it miss life? And finally, if the concept were to be life itself, one would need to ask whether or not it is an apt instrument to provide us with 'access to intelligence'.¹⁵⁵

Canguilhem was probably inspired by Nietzsche who formulated the same problem in a strikingly similar way:

[I]s life to dominate knowledge and science, or is knowledge to dominate life? Which of these two forces is the higher and more decisive? There can be no doubt: life is the higher, the dominating force, for knowledge which annihilated life would have annihilated itself with it. Knowledge presupposes life and thus has in the preservation of life the same interest as any creature has in its own continued existence.¹⁵⁶

Deleuze explains how

Nietzsche often takes knowledge to task for its claim to be opposed to life, to measure and judge life, for seeing itself as an end ... Knowledge *is* opposed to life, but because it expresses a life

¹⁵² Foucault (2004), pp. 139 and 173.

¹⁵³ Canguilhem (2003).

¹⁵⁴ Canguilhem (2002), pp. 335-364.

¹⁵⁵ Ibid, p. 335 (my translation).

¹⁵⁶ Nietzsche (1983), p. 121.

which contradicts life, a reactive life which finds in knowledge a means of preserving and glorifying its type.¹⁵⁷

Canguilhem follows Nietzsche in his discussion of the knowledge of life as a problem without, however, explicitly referring to him (see Chapter 1, para. 1.3.3).

It has been suggested that two phases can be distinguished in Canguilhem's thought with regard to the relation between knowledge and life. In his earlier work, he focuses on the ways in which life can - or cannot - be an 'object of (scientific) knowledge', while in his later work he addresses the notion of information as the concept in (and of) life.¹⁵⁸ Gayon suggests that Canguilhem's references to 'knowledge and life', 'knowledge of life', and 'concept of life' are ambiguous and inconsistent.¹⁵⁹

However, I argue that this ambiguity is not accidental. The use of a particular expression is intentional and serves a purpose. Each of these expressions signifies an important theoretical difference. For example, the title of Canguilhem's books - '*La connaissance de la vie*' - explicitly plays on the difference between knowledge *about* life and knowledge *of* life. Canguilhem suggests that the knowledge of life makes knowledge about life possible,¹⁶⁰ but does not turn the former into the latter. Simply put: knowledge about life is scientific or analytic knowledge, whereas knowledge of life is knowledge as a *technique* of living.

Foucault regards '*Le concept et la vie*' as Canguilhem's most complex and thought provoking essay and hints at its significance in the last essay that he published before his death.¹⁶¹ However, he does not explore in much detail how Canguilhem uses the notion of information in order to question the traditional relation between knowledge and life that Kant established.

It is important to note that Canguilhem regards information not as a metaphor but as a concept. He does not regard it as a preliminary stage in the process of knowing, nor

¹⁵⁷ Deleuze (1983), p. 100.

¹⁵⁸ Gayon (1998), p. 320.

¹⁵⁹ Ibid.

¹⁶⁰ Canguilhem (2003), p. 16.

¹⁶¹ Foucault (1985); Agamben (1999), p. 220: it was the last essay for which Foucault gave his consent for publication.

does he take the notion of information ‘literally’ - as has been suggested.¹⁶² Canguilhem observes:

[A]t the moment, the language of the theory of language and of the theory of communication is being used. Message, information, program, code, instruction, decoding, these are the new concepts of the knowledge of life. But, would we not protest that these concepts are, in the end, imported metaphors like those metaphors through the convergence of which Claude Bernard sought to remedy the lack of an adequate concept? Apparently yes, in fact no. Because that which guarantees the theoretical efficacy or cognitive value of a concept is its function as an operator (*‘opérateur’*).¹⁶³

He describes the concept of information primarily through its function as an ‘operator’; not as an analytical tool that is used to acquire knowledge but as something that has the potential to transform the idea of knowledge itself.

I argue that Canguilhem regards the notion of information in the life sciences as significant because it implies that the process of knowing and the process of living concern the same ‘formation of forms’: concepts and ‘*vivants*’. As a consequence of the notion of information, knowledge and life are no longer necessarily regarded as distinct processes that are subject to different regimes - as Kant proposed. Canguilhem’s idea that knowledge is one of life’s techniques and even its main expression (perhaps due to his bias as a philosopher) is almost identical to Nietzsche’s idea that, as Deleuze formulates it, ‘Life [is] the active force of thought, but thought ... the affirmative power of life.’¹⁶⁴

It could be argued that Canguilhem, through his focus on concepts, elevates knowledge over life in the same way as Kant did. However, it is - in fact - the other way around: Canguilhem regards knowledge as a biological process and as a particular *technique* of living. Foucault describes this idea by observing that the concept is ‘one of the modes of this information which every living being levies on his environment and by means of which, on the other hand, he structures his environment’.¹⁶⁵ He describes how Canguilhem regards the conception of concepts as a technique of living:

[F]orming concepts is one way of living, not of killing life ; it is one way of living in complete mobility and not immobilizing life ; it is showing, among these millions of living beings who

¹⁶² N. Rose (1998), p. 162.

¹⁶³ Canguilhem (2002), p. 360 (my translation).

¹⁶⁴ Deleuze (1983), p. 101.

¹⁶⁵ Foucault (1978), p. xviii.

inform their environment and are informed from it outwards, an innovation which will be judged trifling or substantial as you will : a very particular type of information.¹⁶⁶

Goldstein, probably influenced by Nietzsche, also comes to the conclusion - before Canguilhem - that knowing can only be regarded as a process of living:

[I]t became increasingly clear to me that ... this occurrence can only be understood when one observes that our manner of knowing is essentially related to the structure of biological functioning itself; that biological knowledge is only possible when it is itself recognized as a form of biological functioning. In other words, when between the ideas of the researcher and observed reality exists an adequacy like between the organism and its world.¹⁶⁷

It was, of course, precisely this correspondence between the knowing subject and the world surrounding that subject that Kant struggled to explain. Kant, however, did not come to the same conclusion as Goldstein, Nietzsche, and Canguilhem. He could only represent the process of understanding as a biological process by analogy. Representing such a process as a biological reality would undermine his efforts to establish principles of understanding that were *a priori*, i.e. not derived from experience.

3.2.2 Using Aristotle to criticize Kant

I have argued (see Chapter 2) that Kant established the fundamental conditions of knowledge in relation to living processes. The relation between knowledge and life he set out represents the foundation that supports the whole structure of his system of reason. I argue that in his discussions on the relation between knowledge and life, particularly in '*Le concept et la vie*', Canguilhem is trying to 'deconstruct' (through critiquing the *Critique*)¹⁶⁸ the particular metaphysics that Kant established. Canguilhem is questioning the way in which the relation between knowledge and life has been conceived for over two centuries.

In order to perform this task, Canguilhem turns to a philosophical heavyweight - Aristotle - for support. He observes that Aristotle initially did not separate knowledge from life:

¹⁶⁶ Ibid.

¹⁶⁷ Goldstein (1963), p. 2 (my translation).

¹⁶⁸ Canguilhem (1976), p. 71: Canguilhem does not employ the more fashionable method of 'deconstruction' as it has become known through philosophers such as Derrida. Rather, he uses Kant's own critical method against himself.

th[e] soul is also the form of the '*vivant*'. It is at once life's reality, *ousia*, and its definition, *logos*. The concept of the '*vivant*' is therefore, in the end, according to Aristotle, the '*vivant*' itself.¹⁶⁹

Some commentators have argued that Canguilhem's observation represents a simple identification of the concept and life that necessarily results in a 'theoretical short-circuit'.¹⁷⁰ In other words, identifying life and concept through the notion of a 'concept of life' does not solve the problem of the relation between knowledge and life; it circumvents the question altogether.

However, Canguilhem goes on to discuss how Aristotle's inability to include the 'conception of concepts' within the techniques of living lead him to ultimately introduce a distinction between knowledge and life:

[T]he Aristotelian theory of the active intellect, a pure form without organic support, operates a rupture between intelligence and life and introduces from outside ... as if through a door ... the non-natural or transcendent power that make the essential forms that realize individual beings intelligible. In this way, this theory turns the conception of concepts either into a matter that is non-human or, if it is still a human matter, one that is elevated above life.¹⁷¹

Canguilhem subsequently turns to another, more recent, authority: Hegel. He uses Hegel in order to follow through on Aristotle's original idea that knowledge and life cannot be distinguished because they form part of the same process of the 'formation of forms'. Canguilhem believes that it is much more productive to focus on a German philosopher, such as Hegel, rather than on a French philosopher such as Bergson. The latter does not specifically address the relation between knowledge and life because he does not philosophize about life through concepts.¹⁷² Canguilhem believes that Hegel is ultimately more faithful to Aristotle than Aristotle himself because he observes that 'Life is the immediate unity of the concept to its reality, without the concept distinguishing itself from it.'¹⁷³

Although Hegel's ideas provide Canguilhem with a satisfactory answer, i.e. the distinction between knowledge and life that Kant had introduced was undermined, it gives rise to a different problem. If knowledge and life, or life and concept, can no longer be - conceptually - distinguished then how is a knowledge of life possible?

¹⁶⁹ Canguilhem (2002), p. 336 (my translation).

¹⁷⁰ Lecourt (1975), p. 185; N. Rose (1998), p. 164.

¹⁷¹ Canguilhem (2002), p. 337 (my translation).

¹⁷² Ibid., p. 348.

¹⁷³ Ibid., p. 345, citing Hegel (my translation).

Canguilhem answers this question by relying on his own idea of the vitality of concepts (see Chapter 1, para. 2.1.3):

[I]n any case, Hegel must be asked the question of knowing, if it is true that concept and reality immediately coincide in life, how a knowledge of life through concepts is possible at the level of science. The answer is, obviously, that knowledge can only organise itself through the life of the concept itself.¹⁷⁴

Canguilhem traces, in his own work, the ‘life of a concept’ because such a life envelops many other forms of life (such as that of instruments, scientists, organisms, and philosophers).

Canguilhem uses Aristotle and Hegel in order to criticize Kant. I argue that Kant’s theory of understanding represents the standard or norm from which Canguilhem seeks to distinguish his own ideas. The problem of knowing life, arguably, forms the motivation for both Kant’s and Canguilhem’s work. However, the relation between knowledge and life that Kant proposed in order to ‘solve’ this problem, according to Canguilhem, only exacerbated it. Kant’s theory of understanding ‘intellectualized’ understanding. Canguilhem believes that understanding should not be regarded as a purely cognitive activity of ‘*savoir*’ that consists of thinking the world as exterior to itself.

As opposed to Kant, Canguilhem also does not believe that the transcendental conditions of understanding determine the possibility of science in general - and biology in particular. Rather, he believes that knowledge is only possible through living;¹⁷⁵ especially the knowledge of living processes. This idea represents an alternative to the thought that knowledge requires some distance from its object of study in order to function. However, Canguilhem argues that knowledge at a distance cannot possibly understand living processes. It is not the transcendent categories of understanding that make knowledge of living processes possible but these processes themselves.¹⁷⁶

¹⁷⁴ Ibid., p. 346 (my translation).

¹⁷⁵ Maturana & Varela (1992), p. 11, pick up on this idea and suggest ‘seeing cognition not as a representation of the world “out there,” but rather as an ongoing bringing forth of a world through the process of living itself’.

¹⁷⁶ Canguilhem (2003), p. 16.

In his most outspoken comments on Kant's work, Canguilhem observes that the distance introduced by Kant between knowledge and life represents the 'limit' (or limitation) of his Copernican revolution:

[I]t seems to me to confirm the resistance of the thing, not to knowledge, but to a theory of knowledge that proceeds from knowledge to the thing. This is, in Kant, the *limit of the Copernican revolution*. The Copernican revolution is inoperative when there is no longer an identity between the conditions of experience and the conditions of possibility of experience.¹⁷⁷ (Emphasis added).

It is the character of living processes themselves that reveals this limit of Kant's theory of understanding:

[T]he *transcendental Analytic* revealed the conditions of possibility of knowledge of nature in general and found a limit in the fact that life is not only nature in the sense of '*nature naturée*' but also nature in the sense of '*nature naturante*'.¹⁷⁸

I have argued (see Chapter 2) that this is probably the reason why Kant excludes living processes, as well as aesthetic judgment, from his theory of understanding.

Canguilhem observes how it was Kant's own description of living processes as self-organizing, and as their own cause and effect, that invalidated his ideas on *a priori* knowledge with regard to living processes:

[A]n organized being is a being that is at once its own cause and effect, that organizes itself and reproduces its organization, that forms and repeats itself, in conformity with a type, and whose teleological structure - where parts relate to each other controlled by a whole - is evidence of the non-mechanical causality of a concept. We do not have any *a priori* knowledge of this sort of causality. These forces that are forms and these forms that are forces are precisely of nature, they are precisely in nature, but we do not know it through understanding, we observe it through experience. This is why the idea of a natural end, which is the same idea as that of a self-constructing organism, is not a category in Kant but a regulatory idea whose application can only take place through maxims. In conclusion, Kant does not admit the identification of the logical horizon of the naturalists and that which we could call the poietic horizon of the '*nature naturante*'.¹⁷⁹

Kant recognized the contingency and diversity of living processes and their resistance to his own theory of understanding. However, rather than theorize this contingency further, he sought to contain it by making it understandable through his idea of the 'unity of diversity'. The question remains what would have happened to his theory of understanding if he would have included the contingency of living processes within it.

¹⁷⁷ Canguilhem (2002), p. 351 (my translation).

¹⁷⁸ Ibid., p. 352 (my translation).

¹⁷⁹ Ibid., pp. 344-345 (my translation).

Canguilhem addresses this question implicitly by attributing a central role to ‘error’ in his own discussions on knowledge.

3.2.3 *Knowledge and error*

The idea that the process of living transforms traditional accounts of knowledge was already proposed by Nietzsche. The contingency of living implies that error plays a more important role than truth; or, rather, that the notion of truth itself needs to be reconsidered. Nietzsche observes: ‘Truth is the kind of error without which a certain species of life could not live.’¹⁸⁰ Bachelard similarly observed: ‘The problem of *error* seems to me to come before the problem of truth, or rather, I have found no possible solution to the problem of truth other than dispelling finer and finer errors.’¹⁸¹

Bachelard integrated the idea of error into his thoughts on scientific knowledge through his notion of the ‘epistemological obstacle’.¹⁸² These obstacles are ideas that may have been useful in previous times in relation to specific problems but that have come to hinder knowledge formation.¹⁸³ Bachelard suggests that one important source of such obstacles is traditional philosophy with ‘its tendency to canonize as necessary truths the contingent features of one historical period of thought’.¹⁸⁴ The epistemological obstacle is, therefore, a critical instrument. At the same time, it reveals - what Lecourt calls - “‘a *resistance* of thought to thought’”.¹⁸⁵

Canguilhem addresses how Bachelard exposed the ‘tenacity of errors’ within the history of science. More importantly, Bachelard reveals that the reason for this tenacity of error must be sought within knowledge itself.¹⁸⁶ However, although he describes how epistemological obstacles function and intervene in the process of knowing, Bachelard’s work does not answer the question of the ‘*formation*’ of epistemological obstacles. In other words, the question of ‘what necessity is there in the fact that epistemological obstacles are always being formed and reformed?’¹⁸⁷

¹⁸⁰ Nietzsche (1968), p. 272.

¹⁸¹ Lecourt (1975), p. 54, citing Bachelard.

¹⁸² See Gutting (1989), p. 16.

¹⁸³ Ibid.

¹⁸⁴ Ibid., p. 17.

¹⁸⁵ Lecourt (1975), p. 135, citing Bachelard.

¹⁸⁶ Canguilhem (2002), p. 176.

¹⁸⁷ Lecourt (1975), p. 136.

I believe that this is the question that Canguilhem seeks to answer. He further refines the notion of the epistemological obstacle by regarding it not so much as restricting the progress of knowledge but as playing an important, and inevitable, role in the generation of knowledge.¹⁸⁸ He does this by exploring the role of error in relation to the knowledge of life. Drawing on research into hereditary disease, he explains how the idea of error in relation to the life sciences first emerged when Sir Garrod used the term 'inborn errors' in 1909 in order to describe a disease of the metabolism.¹⁸⁹

The introduction of the notion of information into the life sciences seems to reinforce the significance of the idea of error in relation to the living:

[I]nsofar as the fundamental concepts of the biochemistry of amino acids and macromolecules are concepts borrowed from information theory, such as code or message; and insofar as the structures of the matter of life are linear structures, the negative of order is inversion, the negative of sequence is confusion, and the substitution of one arrangement for another is error.¹⁹⁰

The notion of information, when associated with meaning, seems to evoke the possibility of error. As Canguilhem observes: 'there is no interpretation which does not involve a possible mistake'.¹⁹¹ He anticipates the criticism that his association of living processes with error suggests the attribution of a certain capacity for knowledge to living processes themselves.¹⁹² However, he argues - despite such criticism - that the notions of information and error are equally applicable to the process of living and the process of knowing:

[B]ut it must not be forgotten that information theory cannot be broken down, and that it concerns knowledge itself as well as its objects, matter or life. In this sense to know is to be informed, to learn to decipher or decode. There is then no difference between the error of life and the error of thought, between the errors of informing and informed information. The first furnishes the key to the second.¹⁹³

¹⁸⁸ Cf. Gutting (1989), p. 41.

¹⁸⁹ Canguilhem (1978), p. 171.

¹⁹⁰ Ibid., p. 172.

¹⁹¹ Ibid.

¹⁹² Ibid., Canguilhem observes: 'It would be very tempting to denounce an identification of thought and nature, to protest that the steps of thought are ascribed to nature, that error is characteristic of judgment, that nature can be a witness, but never a judge, etc.'

¹⁹³ Ibid., pp. 172-173.

Both knowledge and life are defined through error, rectification, and mutation. Canguilhem points out that errors should not be regarded as mistakes or as exceptions to a rule. Rather, they represent each time a specific response to a situation.¹⁹⁴

It has been argued that the idea of error only arises in relation to processes with a certain end.¹⁹⁵ However, for Canguilhem error is not indicative of the teleological character of living processes as traditionally understood. Rather, it indicates the contingency and uncertainty that characterizes the process of living. The ‘formation of forms’ is not a process that moves progressively. However, error only gives rise to a temporary ‘*impasse*’ that is subsequently overcome.¹⁹⁶

The notions of error and information reveal something about the process of knowing, as it is traditionally understood, and about the subject of knowledge. Canguilhem argues that if the principles of knowing life can be found in the process of living, rather than in *a priori* forms, then the process of knowing through analytic categories represents a certain dissatisfaction. In other words, if we can know life through living then why would we seek to know it in any other way? He observes:

[M]ust we admit that man has become what he is through mutation, through a hereditary error? Life would then have created, through error, this ‘*vivant*’ that is capable of error ... Man makes mistakes because he does not know where to place himself. Man makes mistakes when he does not place himself in the right environment to receive the particular information that he seeks. But also, it is through this displacement that he receives information or by displacing, through all sorts of techniques, ... objects in relation to each other and this entirety in relation to him. Knowledge is, then, a restless search for the greatest quantity and the greatest variety of information. As a consequence, to be a subject of knowledge, if the *a priori* is in things, if the concept is in life, is merely to be dissatisfied with the meaning found. Subjectivity is, therefore, only dissatisfaction. But that perhaps is life itself. Contemporary biology, read in a certain way, is a kind of philosophy of life.¹⁹⁷

In this statement, Canguilhem plays on the ambiguity of the word ‘*errer*’ in French as signifying both error and displacement. The significance of the latter is explored by Badiou.¹⁹⁸ However, arguably more interesting than the association of error with displacement or movement is the idea that error lies at the heart of knowledge because it is in reaction to error that concepts are formulated. Error is, therefore, the *conditio sine*

¹⁹⁴ Canguilhem (1998), p. 120.

¹⁹⁵ Bensaude-Vincent (1998), p. 76.

¹⁹⁶ Canguilhem (2002), p. 364.

¹⁹⁷ Ibid. (my translation).

¹⁹⁸ Badiou (1998a), pp. 231-233.

qua non of knowledge and understanding that remained largely hidden from view in Kant's work.

The implications of Canguilhem's focus on error in relation to knowledge are addressed by Foucault:

if we admit that the concept is the answer that life itself gives to this chance, it must be that error is at the root of what makes human thought and its history. The opposition of true and false, the values we attribute to both, the effects of power that different societies and different institutions link to this division – even all this is perhaps only the latest response to this possibility of error, which is intrinsic to life.¹⁹⁹

Foucault explicitly asks the question that remains mostly implicit in Canguilhem's discussion on error: 'Is it that the entire theory of the subject must not be reformulated since knowledge, rather than opening itself up to the truth of the world, is rooted in the 'errors' of life?'²⁰⁰ Agamben, who seems to - mistakenly - attribute the ideas on the role of error in relation to knowledge and life to Foucault rather than Canguilhem, observes: 'It is clear that what is at issue in Foucault is not simply an epistemological adjustment but, rather, another dislocation of the theory of knowledge, one that opens onto entirely unexplored terrain.'²⁰¹

I argue that Canguilhem's attribution of a central role to error in relation to knowledge and life is a way of criticizing the particular relation between knowledge and life that has become characteristic of modernity. By introducing the notion of error, he recognizes the contingency of living processes that Kant sought to exclude from his theory of understanding. It is no longer necessary to 'unify' the 'diversity' of such processes in order to make them intelligible. Rather, it is error and contingency itself that represents the condition of possibility of knowledge and understanding. I argue that Canguilhem's idea of 'vital normativity' (see Chapter 6) expresses this idea of error or contingency of living processes. The normative in relation to the living can no longer be understood as a standard or rule by which the living is judged. Rather, normativity represents the contingent techniques of living that make resistance to such norms of judgment possible.

¹⁹⁹ Foucault (1978), p. xix.

²⁰⁰ Ibid., p. xx [sic].

²⁰¹ Agamben (1999), p. 221.

CONCLUSION

Much has been written about how a particular notion of information has shaped research and discourse in both the life and social sciences during the latter half of the twentieth century. The notion now seems to have lost some of its appeal, at least in the life sciences, for various reasons - for example, because of the continuous confusion over its character and meaning and because it has been regarded as introducing an untenable distinction between genetic material and environment. It has been argued that, although the modern notion of information is usually associated with an Aristotelian idea of form, such association is not necessarily plausible. It tends to rely on an oversimplified notion of Aristotelian form as an unchanging pattern that is abstracted from matter. It has been argued that Aristotle's notion of form itself has many forms. However, its most characteristic aspect is that it represents an active principle or process of formation and actualization of potentiality that was intended to challenge the dualism of form and matter elaborated by Plato.

Canguilhem does not focus, with regard to the use of the notion of information in contemporary biology, on the distinction between form and matter. Rather, I have argued that he believes that information as a concept has the potential to transform the relation between knowledge and life that characterized modern rationality. Rather than assuming the separation of knowledge or understanding and living processes, as Kant proposed, Canguilhem uses the notion of information to suggest that knowledge is a form - or technique - of life. The concept of information sheds light on the problem of knowing life that motivates both Kant's and Canguilhem's work.

The introduction of information in the life sciences is often associated with the emergence of new ways of knowing and controlling living processes. It has been argued that a new kind of 'biopower' emerges when living processes are themselves defined by their mobility and movement. Canguilhem's idea of 'vital normativity', that inspired Foucault's notion of 'biopower', is influenced - I will argue - by Kant's ideas on the normative in relation to living processes and Nietzsche's idea of life as a manifestation of 'will to power'. This idea of normativity and its potential significance for the contemporary life and social sciences is explored in the next Chapter.

6. **NORMATIVITY**

PART I

1.1 Introduction

1.1.1 The special status of normativity

In the preceding chapters, Canguilhem's engagement with modern rationality - and specifically with the relation between knowledge and life that informs that rationality - has been addressed with reference to the concepts of environment, individual, and information. However, the most well-known - and arguably also the most misunderstood - of Canguilhem's ideas has yet to be addressed. What role should be accorded to his idea of 'normativity' and how should this idea be understood in the contemporary life and social sciences?

Canguilhem's idea of 'biological normativity'¹ or 'vital normativity'² is generally regarded as obsolete. It is thought to describe the ontology of living processes and has been associated with vitalism, a mode of thought that has become largely irrelevant in the contemporary life sciences.³ Moreover, the distinction between the normal and pathological - by reference to which Canguilhem elaborated his notion of normativity - has allegedly been complicated by notions such as risk, mutation, and enhancement.⁴ Canguilhem's peculiar notion of normativity is said to be significant merely because it inspired Foucault's notion of 'biopower'.⁵

I argue that Canguilhem's ideas on normativity remain relevant to the contemporary life and social sciences. However, such relevance can only be grasped by taking the history of the notion into account and by understanding the role it was originally meant to fulfil. In

¹ Canguilhem (1978), p. 70.

² Ibid., p. 76.

³ N. Rose (1998), p. 164: 'As Lecourt argued twenty-five years ago, there is undoubtedly something of an epistemological short-cut in the way in which Canguilhem appears to derive the normativity of the discourses and practices of the life sciences directly from the ontological normativity of the living being.'; Lecourt (1975), p. 185: 'a theoretical "short-circuit"'.
⁴ N. Rose (2001), p. 7.

⁵ Foucault (1998), p. 140.

other words, it is impossible to discuss Canguilhem's notion of 'normativity' without inquiring into what this idea was meant to critique. A better understanding of the notion also points to a more sophisticated grasp of Foucault's idea of 'biopower'.

Why is the idea of normativity regarded as Canguilhem's main contribution to the philosophy and history of science? Such a role cannot solely be explained by the fact that it was the first significant idea that Canguilhem elaborated, in his thesis on medicine in 1943,⁶ at a time when normative questions regarding the living were fraught with difficulty. The special status of normativity can be explained by reference to Canguilhem's discussion of Kant's 'logical horizon' which means that 'a concept is only analyzed through concepts'.⁷ Canguilhem referred to this 'brilliant text' of Kant but believed that it was necessary to 'break' the vicious character of Kant's conceptual circularity.⁸

Canguilhem's notion of normativity, like the notion of the '*vivant*' that expresses this normativity, cannot be conceptualized by reference to other concepts. This is because his idea of normativity not only informs the concepts that have been discussed in previous chapters, but - more importantly - it is employed by Canguilhem to make a philosophical statement about the 'conception of concepts'.⁹ It does not primarily describe the originality or ontology of living processes, as is commonly argued; rather, it envelops and expresses Canguilhem's critique of *Critique* - his engagement with modern rationality - in one 'operative notion'.¹⁰

I argue that his idea of normativity is significant for the social sciences because, although he discussed vital normativity with regard to living processes, he in fact devised a new theoretical instrument. Traditional connotations of normativity with morality and with the distinction between norm and fact - as well as later associations of normativity with normalization and control - have overshadowed the original intention and significance of Canguilhem's notion of normativity. This chapter seeks to recover that meaning and potential by inquiring into the genealogy of the idea of a biological normativity.

⁶ Canguilhem (2006).

⁷ Canguilhem (2002), p. 343.

⁸ Ibid., pp. 343-344.

⁹ Ibid., p. 344.

¹⁰ Maturana & Varela (1980), p. 96, use this term in relation to unity (and its distinction).

PART II

2.1 The genealogy of ‘vital normativity’

2.1.1 *Kant and the normative*

In order to understand Canguilhem’s notion of normativity it is necessary to return to its two main influences. Although the notion has also been associated with Aristotle’s idea of form (see Chapter 5), I argue that it was perhaps more directly influenced by the ideas on norms and living processes of Kant and Nietzsche respectively. Apart from his discussion of norms in relation to morality, which is not addressed here, Kant discussed normativity specifically with regard to living processes through the idea of the ‘lawlikeness of the contingent’ (see Chapter 2).¹¹

Kant did not attribute purposiveness or ‘lawlikeness’ to living processes themselves. Rather, these notions merely enable humans to judge - rather than understand - living processes. Without this principle there was no way in which the empirically diverse living processes could be unified in order to make them intelligible. The ‘lawlikeness of the contingent’ is, therefore, a cognitive tool that does not claim any validity with regard to organisms themselves. It merely provides us with an idea of how organisms ‘should’ function so that it becomes possible to judge these organisms as normal or pathological in relation to their ‘concept’.¹²

At the same time, Kant proposed that self-generation is characteristic of living processes. Each living process is its own cause and effect.¹³ It seems, therefore, as if there are two kinds of norms at work with regard to living processes in Kant’s work. One is the norm through which a human subject judges a living process and the other is a norm expressed by the self-generation of living processes themselves. The norm understood as self-generation and self-organization of the living cannot be equated with the moral or subjective norm that is used in order to judge or cognize this process of self-generation.

¹¹ Kant (1987), p. 405, section VI, para. 217: ‘purposiveness is a lawfulness that [something] contingent [may] have [insofar] as [it] is contingent’.

¹² Ginsborg (2001), p. 249.

¹³ Kant (1987), p. 249, section 64, para. 371: ‘with regard to its *species* the tree produces itself ... it is both cause and effect, both generating itself and being generated by itself ceaselessly’.

These two different ideas of normativity seem to be at odds with each other and remain more or less separate in Kant's theory. It should be pointed out that Kant himself did not refer to the normativity of living processes as such, but only referred more generally to the 'diversity' of empirical laws that characterize the living. Nevertheless, Kant's ideas potentially gave rise to the notion of an 'immanent normativity'¹⁴ of the living that has arguably served as inspiration for theories of autopoiesis. Such theories distinguish the autopoietic process from external judgment or observation¹⁵ and, therefore, mirror the two different levels of normativity that can be found in Kant.

It could be argued that Kant did not wish to recognize normativity at the level of the living process because he was concerned with understanding and cognition rather than with the world of experience. However, recognition of an immanent normativity of living processes would also have resulted in the impossibility of the unification of diversity necessary for judgment.¹⁶ Norms, understood as the rules or principles that are employed by a subject in order to make knowledge or judgment possible, represent the main instruments of modern rationality. When normativity is associated with living processes, however, it becomes rationality's 'blind spot'.¹⁷

2.1.2 Nietzsche and normativity

Nietzsche sought to criticize Kant's rationalism by exploring the idea of the living as value rather than as object of evaluation or judgment. It sometimes goes unnoticed that one of the greatest challenges for, and influences on, Nietzsche was Kant: 'For Nietzsche, as for Hegel, Kant is the philosopher with whom one must come to terms. One must either become a Kantian, or, starting from a Kantian foundation, think one's way out of Kantianism.'¹⁸ As a young man, Nietzsche wrote: 'Kant, Schopenhauer, and this book of Lange's - I don't need anything else.'¹⁹ Only much later did Nietzsche describe Kant as 'that most deformed concept-cripple of all time'.²⁰ However, it was undoubtedly through Kant's influence that Nietzsche began to think about the particularity of living processes. In

¹⁴ Zammito (2006), p. 753; Ibid., p. 760, referring to Ginsborg's interpretation of Kant's 'lawlikeness'.

¹⁵ Maturana & Varela (1980), p. 78.

¹⁶ Cf. Zuckert (2007), pp. 25 and 48: the contingency and diversity of living processes represents a 'threat' to Kant's system of reason.

¹⁷ Maturana & Varela (1992), p. 19. See also Chapter 3, para. 3.1.1.

¹⁸ Kevin Hill (2003), p. 6.

¹⁹ Ibid., pp. 6-7.

²⁰ Ibid., p. 24.

1867, he wrote the outline for a doctoral dissertation provisionally entitled 'The Concept of the Organic since Kant'.²¹

In the excerpts that remain, Nietzsche argues - much like Kant - that organisms do not exist as individual 'wholes' but that they are merely represented as such in order to make them intelligible. He observes that the 'organism [does] not belong to the thing in itself. The organism is form. If we abstract away the form, it is a multiplicity'.²² Similarly to Kant, he argues that it is impossible to know or understand living processes. However, the important difference between Nietzsche and Kant is that Nietzsche believed that such processes are not merely objects of our knowledge or judgment. As Kevin Hill points out: 'Nietzsche cannot put aside the vitalist intimation that in *being* a living being, something felt, some power or "life force", operates in him and through him.'²³

Nietzsche regarded his own work as a critical engagement with Kantian *Critique*. As Deleuze observes:

[O]ne of the principle motifs of Nietzsche's work is that Kant had not carried out a true critique because he was not able to pose the problem of critique in terms of values. And what has happened in modern philosophy is that the theory of values has given rise to a new conformism and new forms of submission.²⁴

According to Nietzsche, Kant's philosophy resulted in a situation where one 'moves in the *indifferent* element of the valuable in itself or the valuable for all'.²⁵ Nietzsche argues against those 'who remove values from criticism, contenting themselves with producing inventories of existing values or with criticizing things in the name of established values', but also against those 'who criticize, or respect, values by deriving them from simple facts'.²⁶ He demonstrated how Kant's representation of principles of understanding as *a priori* meant that the human creation and normative inspiration of such principles goes unquestioned.²⁷ As Deleuze explains, herein lies the productivity of Nietzsche's 'reversal of values':

²¹ Ibid., p. 83; see also pp. 84-85 for the outline of Nietzsche's thesis.

²² Ibid., p. 89.

²³ Ibid., p. 93.

²⁴ Deleuze (1983), p. 1.

²⁵ Ibid.

²⁶ Ibid.

²⁷ Ibid., p. 2: In order to remedy this, Nietzsche creates the idea of 'genealogy' as signifying 'both the value of origin and the origin of values'.

[I]n fact, the notion of value implies a *critical* reversal. On the one hand, values appear or are given as principles: and evaluation presupposes values on the basis of which phenomena are appraised. But, on the other hand and more profoundly, it is values which presuppose evaluations, 'perspectives of appraisal', from which their own value is derived. The problem of critique is that of the value of values, of the evaluation from which their value arises, thus the problem of their *creation*.²⁸

Nietzsche's focus on the creation and normative origin of values gives rise to subsequent interpretations of the norm as 'productive'. In other words, a norm is not a pre-existing or *a priori* principle that represents a standard or an ideal by reference to which things can be judged. Rather, the norm is itself generated by value and, in turn, gives rise to values. Nietzsche believed that he, more than anyone else, was capable of addressing values and normativity because of the unique perspective that his own illness provided him with:

[T]o be able to look out from the optic of sickness towards *healthier* concepts and values, and again the other way around, to look down from the fullness and self-assurance of the *rich* life into the secret work of the instinct of decadence, that was my longest training, my genuine experience, if I became the master of anything, it was this. I have a hand for switching *perspectives*: the first reason why a 'revaluation of values' is even possible, perhaps for me alone.²⁹

Nietzsche addresses, in the citation above, the heterogeneity of normality and pathology that Canguilhem subsequently explored (see para. 3.1.1 below). He also suggests that the distinction between health and sickness, or the normal and the pathological, is a question of value that is only determined by the living itself. No value can be attributed to life by reference to an existing norm, nor can value be derived from life itself. These themes later inform Canguilhem's notion of vital normativity. As Badiou explains:

Nietzsche emphasizes that life produces deviations from values, it is an evaluating '*puissance*' and an active divergence. But, in itself, it is impossible to evaluate and neutralize. The value of life, says Nietzsche, cannot be valued.³⁰

Life, therefore, does not represent a standard of evaluation or an absolute value in itself - an idea that is often associated with vitalism. Rather, the value of life can only be evaluated by the particular life that leads it. Similarly, Canguilhem's notion of normativity does not represent a value in itself but a capacity to - as Nietzsche calls it - 'switch perspectives' or challenge established norms of evaluation and institute new ones. This means that the emphasis shifts from a focus on the norm as rule or standard and the conformation to, or deviation from, such a rule to the values that underlie norms and that make norms emerge and proliferate.

²⁸ Ibid., p. 1.

²⁹ Nietzsche (2005), p. 76; Deleuze (2001), p. 58.

³⁰ Badiou (1998b), p. 66 (my translation).

2.1.3 Nietzsche and life as 'will to power'

The influence of Nietzsche's ideas on Canguilhem's work is obvious but has not been explored in any detail. Canguilhem himself only refers to Nietzsche a few times in his work and when he does he sometimes represents Nietzsche's ideas as contrary to his own (see Chapter 1, para. 1.3.3).³¹ Nevertheless, his notion of 'vital normativity' perhaps most closely resembles Nietzsche's idea of life as a manifestation of 'will to power'.³² Although the connotation of power is only recovered by Foucault in his notion of 'biopower', Canguilhem draws on Nietzsche's idea of 'will to power' in order to explain how living processes can be characterized by their 'dynamic polarity' (*polarité dynamique*)³³ and self-overcoming rather than by their self-preservation.

Nietzsche's philosophy is influenced by his reference to a kind of organic 'will to power' that 'suffuses his argument with a biological ethos'.³⁴ For Nietzsche, Kant's focus on reason and morality disguises an underlying truth that can only be found in the process of living.³⁵ This is why Nietzsche suggests that 'moral values are illusory values compared with physiological values'.³⁶ Bergson was undoubtedly influenced by Nietzsche's work when he observed:

[L]et us then give the word biology the very wide meaning it should have, and will perhaps have one day, and let us say in conclusion that all morality, be it pressure or aspiration, is in essence biological.³⁷

However, there is an important difference between Nietzsche's original proposition and Bergson's subsequent observation. Nietzsche did not propose some sort of physiological morality but a questioning of Kantian morality through physiology. Another question is whether Nietzsche, through such questioning, only achieved a different kind of 'moralism'.³⁸

³¹ Stiegler (2001), p. 85.

³² Nietzsche (1968), pp. 332-333: 'The victorious concept "force", by means of which our physicists have created God and the world, still needs to be completed: an inner will must be ascribed to it, which I designate as "will to power"'.
³³ Canguilhem (1978), p. 70; Canguilhem (2006), p. 77, uses this term most frequently to describe living processes.

³⁴ Tauber (1994), p. 250.

³⁵ Ibid., p. 259.

³⁶ Ibid., p. 250, citing Nietzsche.

³⁷ G. Rose, (1984), p. 95 and 94, citing Spencer: 'morality is essentially one with physical truth - is, in fact, a species of transcendental physiology'.

³⁸ Ibid., p. 71.

It is necessary to clarify briefly what Nietzsche means by the notion of 'will to power'. For Nietzsche, all activity - including living - signifies a certain striving for power.³⁹ This means that the activity of life does not merely consist of adaptation to exterior circumstances or to a presupposed environment: 'life is not the adaptation of inner circumstances to outer ones, but will to power, which, working from within, incorporates and subdues more and more of that which is "outside"'.⁴⁰ Nietzsche, who frequently refers to Newton's physics in his work, associates his idea of 'will to power' with Newton's notion of 'force' (even if this notion remains largely undefined in Newton - see Chapter 3, para. 2.1.2).⁴¹

Life or living cannot be equated with the will to power. Rather, life should be regarded as one of its manifestations: 'life is merely a special case of the will to power; - it is quite arbitrary to assert that everything strives to enter into *this* form of the will to power'.⁴² The idea of life as a productive force means that it cannot be turned into an absolute value, an ideology, or a standard of evaluation. Nietzsche observes: 'life is only a *means* to something; it is the expression of forms of the growth of power'.⁴³

The 'will' that Nietzsche refers to in the notion of 'will to power' does not refer to an intentional or conscious act of willing by a subject.⁴⁴ It does not designate a will that wishes for power because that would indicate a lack and turn the will to power into a reactive rather than an active force. This idea, arguably, also motivates Foucault's later differentiation of biopower from sovereign power. As Deleuze observes, the will to power 'is not that which the will wants, but *that which* wants in the will'.⁴⁵ In other words, the will has no object other than itself; it represents its own motivation.

Nietzsche observes that 'there is absolutely no other kind of causality than that of will upon will'.⁴⁶ This idea of 'will upon will', or force upon force,⁴⁷ indicates a certain dynamic or polarity:

³⁹ Nietzsche (1968), p. 347: 'What is "active"? - reaching out for power.'

⁴⁰ Ibid., p. 361.

⁴¹ Ibid., pp. 332-333.

⁴² Ibid., p. 369.

⁴³ Ibid., p. 375.

⁴⁴ Ibid., pp. 353 and 369.

⁴⁵ Deleuze (2001), p. 73.

⁴⁶ Nietzsche (1968), p. 347.

⁴⁷ Deleuze (1999), p. 59, discussing Nietzsche's influence on Foucault's idea of power (citing Foucault): 'force has no object other than that of other forces, and no being other than that of relation: it is "an action upon an action, on existing actions, or on those which may arise in the present or future"; it is "a set of actions upon other actions"'; See also Pottage (1998b).

[I]t is necessary to measure the meaning of all these 'ideal drives' against *life* to grasp what this antagonism really is: the struggle of sickly, despairing life that cleaves to a beyond, with healthier, more stupid and mendacious, richer, less degenerate life. Therefore it is not 'truth' in struggle with life but *one* kind of life in struggle with another.⁴⁸

This idea of life as struggle or polarity is reflected in Canguilhem's notion of 'vital normativity'. Whereas the norm in Kant represents a rather static rule or principle that makes understanding or judgment possible, Canguilhem observes that 'the normal is not a static or peaceful, but a dynamic and polemical concept'.⁴⁹ The idea of the 'norm' or 'normativity' necessarily represents value and evaluation. This also means that the notion of 'vital normativity' itself represents a normative project and expresses Canguilhem's own "vital" politics'.⁵⁰ Otherwise, this notion of normativity would merely provide an alternative principle of judgment to that of Kant; it would be synonymous with, or merely describe, the empirical diversity of singular living processes and would, therefore, lack critical power.⁵¹

2.2 Traditional interpretations of the normative

2.2.1 *The distinction between norm and fact*

Before we address the way in which Canguilhem elaborated the notion of normativity, it is important to discuss the traditional interpretation of the normative so that Canguilhem's notion can subsequently be contrasted with it. Perhaps the most common understanding of 'normativity' is determined by the distinction between norm and fact. This distinction was consolidated by Kant's separation of understanding and experience.

The focus on the diversity of 'biological facts' that emerge from recent techniques of visualization and isolation seems to confirm the distinction between norm and fact in relation to living processes.⁵² The adherence to this distinction not only prevents inquiries into the values that motivate representations of the biological as factual but also gives rise to an attitude of '*c'est ainsi*', i.e. a tacit acceptance of existence in relation to the

⁴⁸ Nietzsche (1968), pp. 323-324.

⁴⁹ Canguilhem (1978), p. 146.

⁵⁰ N. Rose (2001), p. 1, uses this term.

⁵¹ Macherey (1998), p. 76.

⁵² Pottage (2002), p. 289: the relation between biological fact and legal norm becomes more complicated.

biological.⁵³ Canguilhem would perhaps say that it signifies the return to a situation where living processes are regarded as having no ‘ontological originality’ and as not ‘pos[ing] any special theoretical problem’.⁵⁴

The emergence or construction of facts, particularly with regard to the physical and chemical sciences, has been the subject of some discussion.⁵⁵ However, the idea of a ‘biological fact’ gives rise to a different question, namely, how might such a facticity of vitality be imagined? Whereas in physics a fact is mostly associated with a ‘cognitive construct’, facticity in the life sciences is associated - perhaps paradoxically - with the normative.⁵⁶

It has been suggested that it is this question of the facticity of vitality that animates Canguilhem’s notion of normativity.⁵⁷ However, the particular factual status of living processes does not call into question the traditional distinction between facts and norms itself. Rather, it ‘copies’ that distinction over into life.⁵⁸ It can be safely assumed that Canguilhem did not rely on the distinction between fact and norm in his elaboration of the notion of ‘vital normativity’. Indeed, it was this very distinction that he sought to undermine.

2.2.2 *Normativity as control*

The distinction between norm and fact determines many interpretations of the normative. However, normativity in relation to living processes is also often associated with control. It has been suggested, with reference to the distinction between normality and pathology that Canguilhem addressed, that the contemporary life sciences are less concerned with ‘the poles of illness and health’ and more concerned ‘with our growing capacities to control,

⁵³ Dagognet (1997), p. 70: Dagognet argues that Canguilhem’s discussion on cellular theory seems to negate his own ideas on normativity through - what Dagognet calls - ‘mere microscopic facticity: *c’est ainsi*’ (my translation).

⁵⁴ Canguilhem (1947), p. 324 (my translation).

⁵⁵ See, e.g., Fleck (1979); Latour & Woolgar (1986), p. 235, on the construction and ‘stabilisation’ of facts; *ibid.*, pp. 174-175, on the inherent ambiguity of facts; *ibid.*, p. 64 on the role of instruments in fact construction.

⁵⁶ Gayon (2005), p. 57; *ibid.*, p. 56: Bergson emphasized this difference between physical and biological facts and suggested that the latter seem to derive their ‘facticity’ from nature and from the self-containment that characterizes the organic in general.

⁵⁷ *Ibid.*, p. 57.

⁵⁸ Pottage (2002), p. 292.

manage, engineer, reshape, and modulate the very vital capacities of human beings as living creatures'.⁵⁹

Rose - for example - observes that the 'binary distinction'⁶⁰ between the normal and pathological in medicine is no longer relevant in an era that deals primarily with enhancement, mutation, risk, and susceptibility rather than the correction of abnormality or the restoration of illness and pathology.⁶¹ The notion of 'risk' is regarded as escaping the logic of the normal and the pathological altogether.⁶² I argue that risk is itself a normative evaluation in relation to the same distinction.⁶³

The focus on risk or susceptibility can also be regarded as a 'rapid extension of the pathological'⁶⁴ rather than as a manifestation of an entirely new regime, thereby making Canguilhem's original ideas more, rather than less, relevant. The implication of such an extension of the pathological will not be discussed in further detail here. It should be pointed out that Canguilhem primarily uses the distinction between the normal and the pathological in order to elaborate a new notion of normativity.

Rose suggests that we have entered into an age of 'biological control' where 'contemporary medical technologies do not seek merely to cure diseases once they have manifested themselves, but to control the vital processes of the body and mind'.⁶⁵ The 'molecularization' of life facilitates such control now that 'intervention is no longer constrained by the normativity of a given vital order'.⁶⁶ Since Canguilhem's idea of vital normativity is thought to express such an organic order at a time when fragmented processes disprove its existence, normativity is regarded as obsolete. Vital norms that were previously regarded as 'inescapable' in the sense that they were thought of as 'inscribed in the laws of organic life' now 'appear open to alteration'.⁶⁷

⁵⁹ N. Rose (2007), p. 3.

⁶⁰ Ibid., p. 70.

⁶¹ N. Rose (2001), pp. 7 and 11.

⁶² N. Rose (2007), p. 84.

⁶³ See, e.g., Bayatrizi (2008), p. 139: 'The construction of these risk categories constitutes a norm-establishing practice in that high-risk groups are defined as those in which the actual mortality rate deviates from the "normal" mortality rate in the standard population.' See also Arendt (1998), p. 41.

⁶⁴ Gros (1993), p. 104, citing Limoges (my translation).

⁶⁵ N. Rose (2007), p. 16.

⁶⁶ Ibid., p. 14.

⁶⁷ Ibid., pp. 17 and 81.

This idea of an organic order seems to be mostly derived from medicine, the traditional purpose of which is the restoration of a certain normative - or 'healthy' - state.⁶⁸ It could be argued that Canguilhem's focus on medicine necessarily limits his conception of normativity. Medicine represents, as Rheinberger argues, a somewhat 'peculiar cultural formation' with its own epistemology and normativity that centres around the maintenance of integrity rather than transgression or enhancement.⁶⁹ However, Canguilhem does not undertake a philosophy of medicine in the traditional sense. Rather, like Bachelard before him, he uses medicine and the life sciences in order to probe philosophical questions and investigate 'preserved problems' (see Chapter 1, para. 2.1.4).

According to Rose, the significance of Canguilhem's original notion of 'normativity' lies in the way in which it anticipates Foucault's discussion about judgments on normality and 'normalization':

[I]t becomes clear 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. This opens up the normativity of life for experimentation and manipulation: the therapeutic maximization of 'quality of life' in the name of normality.⁷⁰

He also notes how

the productivity of Canguilhem's reflections on norms in life lies less in his insistence on the vitality of life than in the light that it sheds on the character of those other norms that traverse our culture - the norms of intelligence, of mental functioning, of normality itself.⁷¹

However, I argue that Canguilhem devised the notion of 'normativity' precisely to reveal - and get away from - the particular Kantian idea of the norm as judgment of the living and as standard for correction.

These comments, furthermore, suggest that it is impossible for the living to escape normalization once biological normativity is recognized as a concept; normativity is regarded as something that is 'in' living processes, that can be seized upon and - in turn - applied 'to' it. I argue that such a 'normalizing of normativity' neutralizes the critical potential of Canguilhem's original notion of vital normativity and of Foucault's subsequent

⁶⁸ Ibid., p. 81.

⁶⁹ Rheinberger (1995), pp. 250-251.

⁷⁰ N. Rose (1998), p. 165.

⁷¹ Ibid., p. 164.

idea of 'biopower'. This interpretation often goes hand in hand with the understanding of 'biopower' as a power that is exercised 'over' life.

2.2.3 '*Biopower*' as power over life

The few references to 'biopower' or 'biopolitics' in relation to living processes in contemporary biology remain sketchy.⁷² Most merely suggest that informatically fragmented and mobilized biological entities provide a greater possibility for control and manipulation of such entities (see Chapter 5, para. 1.1.2). The interpretation of the normative as control, or as the exercise of power over life, is perhaps facilitated by a particular interpretation of Foucault's idea of 'biopower'.

Foucault argues that modernity is characterized by a specific kind of power. He calls this 'biopower' and distinguishes it from the traditional idea of power as exercised by a sovereign over his subjects that characterized the Middle Ages.⁷³ Sovereign power was concentrated in the authority and person of the sovereign who decided on life and death. Biopower signifies a different form of power that is more concerned with 'making' live ("*faire*" *vivre*) and 'letting' die ("*laisser*" *mourir*) rather than the 'making die' and 'letting live' that characterized the power of the sovereign.⁷⁴

However, the most important - but more implicit - characteristic of 'biopower' that Foucault describes seems to have been lost in most interpretations of the notion. The kind of power that he discusses is not so much wielded 'over' or applied 'to' the living by a subject of authority, such as a sovereign, or by any other subject. Foucault refers to sovereign power as a power that is exercised 'over' life and is precisely concerned with the subsequent transformation of this idea of power.⁷⁵ 'Biopower', instead, concerns the actualization or operation of power as manifested through certain *techniques* of living. It, therefore, bears more resemblance to Nietzsche's idea of 'will to power' and Canguilhem's 'vital normativity'.

⁷² See, e.g., Helmreich (2003), p. 352; Kay (2000), p. 3.

⁷³ Foucault (1998), pp. 135-145.

⁷⁴ Foucault (1997), p. 214.

⁷⁵ Foucault (1998), p. 139.

Most interpretations of Foucault's idea of 'biopower', however, do not engage much with the history of this idea and this - I argue - affects how biopower has come to be conceived. It is often regarded as involving a relocation, dispersion, or distribution of power from a sovereign to various individuals or experts. For example, reference is made by Rose to a kind of 'pastoral power' that is not administered by the State but by a variety of actors.⁷⁶

Such an interpretation, I argue, misses out on how Foucault intended to conceive of an entirely different *kind* of power. The intention was to transform the notion of power as such or, at least, to describe how this notion was transformed by modernity. The idea of a dispersion or displacement of power concerns the exercise or delegation of power rather than the idea of power itself. In fact, the idea of 'pastoral power' relies on the traditional idea of sovereign power; power that is exercised by subjects 'over' life. I believe that this misinterpretation of the notion of 'biopower' may have something to do with a confusion between this notion and another Foucauldian idea, that of 'governmentality'. More specifically, the idea of governmentality interpreted in a rather sterile manner as concerning 'the multiplicity of forms and sources of authority'.⁷⁷

When biopower is regarded as a power that is exercised 'over' life,⁷⁸ this inevitably gives rise to a confusion of sovereign power and biopower. It turns biopower, in Nietzsche's words, into a reactive force rather than an active or productive one. It also means that the transformation of the notion of power as such, which was Foucault's main concern, goes unrecognized. What happens when life becomes subject? What happens when life is no longer regarded as merely the object of knowledge and power? These are the questions that represent a persistent theme in the work of Nietzsche, Canguilhem, and Foucault. They were concerned with how traditional notions of power or knowledge might be changed by regarding them primarily as processes or techniques of life.

It has been argued that Nietzsche's thoughts on power can be distinguished, in this regard, from those of Foucault:

[P]ower for Foucault is an object for analysis, whereas for Nietzsche power is the true subject - the protagonist of his inquiry. For Foucault power is but a means to define the self, and therefore it cannot constitute the self's very basis, as in Nietzsche's understanding. Consequently their

⁷⁶ N. Rose (2001), p. 9.

⁷⁷ Rabinow & Rose (2006), p. 200.

⁷⁸ N. Rose (2007), p. 52: 'In volume 1 of *The History of Sexuality*, Foucault proposed a now familiar bipolar diagram of biopower, or power over life.'

respective conceptualizations of power and of the body as the expression (Nietzsche) or object (Foucault) of power project divergent avenues of thought.⁷⁹

Although Foucault's earlier work on normalization and the disciplining of bodies can perhaps be regarded as objectifying life,⁸⁰ his discussion of 'biopower' closely resembles Nietzsche's idea of life as a manifestation of 'will to power'. The body, any living process, is not so much an object of power but a manifestation and an expression of it. The understanding of 'biopower' as a power that is exercised 'over' life and that implies correction and control perhaps indicates a confusion with Foucault's earlier work.⁸¹

Since the history of the notion of biopower is not recognized, power is represented in a rather one dimensional way as control. Reference is made to a 'contemporary logics of control'.⁸² This notion of control, which is often associated with the concept of information (see Chapter 5), comes to inform all aspects of inquiry into the effects of the contemporary life sciences: the formation of subjectivities, the molecularization of processes and entities, new forms of expertise, and the emergence of bioeconomics.⁸³ Meanwhile, the representation of control is conceptually simplistic; its techniques and programs are represented as ways of executing, exercising, or applying power rather than as forming part of the very constitution of such power.

Rose suggests that 'biopower is more a perspective than a concept' because 'it brings into view a whole range of more or less rationalized attempts by different authorities to intervene upon the vital characteristics of human existence'.⁸⁴ Although I disagree with this interpretation of biopower, it is certainly true that biopower - much like Canguilhem's normativity - is not really a 'concept among concepts'.⁸⁵ However, I argue that it is more than a 'perspective'; it is a critique of *Critique*.

I believe that biopower was conceived by Foucault with more or less the same motivation as Canguilhem's vital normativity. It was intended to conceive of the way in which knowledge and power are transformed through the processes that characterize the

⁷⁹ Tauber (1994), p. 272.

⁸⁰ Foucault (1995).

⁸¹ See, e.g., Tauber (1994), p. 273: 'Foucault analyzes power as a societal weapon to establish hegemony over the individual's body, action, and thought. In this scheme the body becomes an object, and power becomes the means of control.'

⁸² N. Rose (2001), p. 9.

⁸³ See, generally, Rose (2007).

⁸⁴ *Ibid.*, p. 54.

⁸⁵ Canguilhem (2002), p. 344.

predicaments of life: the acting, selecting, preferring techniques that are not employed by a subject but give rise to all sorts of forms, including the subject. It does not concern a power or control in the traditional sense that is exercised over life by certain authorities, individuals, experts, or collectives. Biopower signifies an entirely different notion of power where power, knowledge, and life are implicated in each other rather than subject or object of one another.

PART III

3.1 The history of ‘vital normativity’

3.1.1 The normal and pathological

Canguilhem began his inquiry into the normal and the pathological by asking why the concept around which medicine is organized and on which its therapeutic purpose relies, namely normality and the restoration of the normal, goes unquestioned. The notion of the ‘normal’ in medicine is as fundamental as it is undertheorized. In order to remedy this situation, Canguilhem started with an inquiry into the assertion that has dominated medicine since the nineteenth century, namely that ‘pathological phenomena are identical to corresponding normal phenomena save for quantitative variations’.⁸⁶ He questioned this idea of the homogeneity of the normal and the pathological.

Canguilhem revealed how the idea of such a homogeneity and continuity of living processes only recently emerged by contrasting it with two previous ideas. The first is the ‘ontological’ idea of illness that emerged, according to him, at the time of Pasteur’s ‘discovery’ of microbes.⁸⁷ This idea relies on a representation of illness as something identifiable that either enters or leaves the body and results in a different state of that body. The therapeutic aim of medicine is then regarded as the restoration of a previous situation through the identification and localization of this alien entity. The second idea goes back to ancient Greece where illness was represented as something that could not be localized,

⁸⁶ Canguilhem (1978), p. 8.

⁸⁷ *Ibid.*, p. 11.

because it represented a disharmony or disequilibrium between different forces in the body. As opposed to the ontological idea of illness, this idea represents illness as dynamic.⁸⁸

Canguilhem points out that neither of these ideas assumes the homogeneity of the normal and the pathological. Both ideas represent illness as a 'polemical' situation, as he calls it. The first through the image of the battle between the body and a foreign intruder and the second through the image of a battle between different forces within the body.⁸⁹ Canguilhem retains from this discussion the idea of the '*dynamic polarity*' of life to which he frequently refers and which characterizes his idea of 'vital normativity'.⁹⁰ Both ideas, furthermore, propose that the states of normality and pathology differ qualitatively rather than quantitatively.

The idea that the normal and pathological states are quantitatively rather than qualitatively different was generally accepted in the nineteenth century.⁹¹ Living processes were regarded as remaining essentially identical throughout time; it was only a difference in degree that resulted in illness. Such an idea has as its consequence that illness as a state in itself is not recognized and there are only gradations of health. Canguilhem argues that this identity between the normal and pathological was advocated by Comte, who further developed the ideas of Broussais on the relation between pathology and physiology.⁹²

Canguilhem points out the difficulty that lies at the heart of the identification of the normal and the pathological and demonstrates how Broussais, Comte, and Bernard, while emphasizing homogeneity and only quantitative difference between the normal and the pathological, in fact rely on qualitative arguments. For example, all three refer to a loss of harmony when describing the pathological state, while this is very much a qualitative notion or, as Canguilhem says, 'a qualitative and polyvalent concept, still more aesthetic and moral than scientific'.⁹³ He, furthermore, observes that

the vagueness of the notions of *excess* and *deficiency* and their implicit qualitative and normative character is even more noticeable, scarcely hidden under their metrical pretensions. Excess or deficiency exist in relation to a scale deemed valid and suitable – hence in relation to a norm. To define the abnormal as too much or too little is to recognize the normative character of the so-called

⁸⁸ Ibid., pp. 11-12.

⁸⁹ Ibid., p. 12.

⁹⁰ Ibid., p. 13.

⁹¹ Ibid., p. 14.

⁹² Ibid., p. 17; Ibid., p. 141: It is interesting to note that Canguilhem refers to Kant who said that in fact pathology gave rise to physiology rather than the other way around.

⁹³ Ibid., p. 21.

normal state. This normal or physiological state is no longer simply a disposition which can be revealed and explained as a fact, but a manifestation of an attachment to some value.⁹⁴

The impossibility of separating the quantitative and the qualitative, or the norm as standard and the norm as value, signifies the inherent ambiguity of the notion of the norm. For example, physiological constants are regarded as normal in a statistical and descriptive sense but also in a therapeutic and normative sense.⁹⁵ Canguilhem regards this ambiguity of the norm as productive: 'this ambiguity is certainly instructive in that it reveals that the problem itself persists at the heart of the solution presumably given to it'.⁹⁶

3.1.2 *The ambiguity of the normative*

An important aspect of Canguilhem's discussion of normativity is the ambiguity that has traditionally been associated with the idea of the norm or the normal.⁹⁷ The meanings attributed to the idea of the norm have varied over time and differ according to context. The norm was, for example, in antiquity associated with architecture and geometry and referred to an instrument used to draw straight lines and angles.⁹⁸ Only later was the idea of the norm equated with the rule and with that which makes evaluation possible. From the beginning of the nineteenth century, the use of words referring to the norm proliferated so that - in French - words emerged such as '*normalité*', '*normative*', and '*normalisation*', arguably signifying an 'extension of the norm's domain'.⁹⁹

The norm came to be associated with the idea of a statistical average or standard through Quetelet's creation of a formula, through a 'blending of traits', which resulted in the idea of the 'average man'.¹⁰⁰ The norm as average made it possible to individualize by reference to this norm. Quetelet's motivation for the elaboration of the idea of the average man was political and social rather than scientific. His creation represented 'a physical manifestation of the new political regime of the *Juste Milieu* ... and of the democratization of society after the fall of the *Ancien Regime*'.¹⁰¹ Quetelet observed:

⁹⁴ Ibid., p. 23.

⁹⁵ Ibid., p. 68.

⁹⁶ Ibid., p. 36.

⁹⁷ Ibid., p. 69.

⁹⁸ Ewald (1990), p. 139.

⁹⁹ Ibid., p. 140.

¹⁰⁰ Ibid., p. 144; Canguilhem (1978), pp. 89-91.

¹⁰¹ Matthews David (2006), p. 143.

[T]his determination of the average man is not merely a matter of speculative curiosity; it may be of the most important service to the science of man and the social system ... The average man, indeed, is in a nation what the centre of gravity is in a body.¹⁰²

The differing interpretations of the norm as middle or centre, rule, and standard or average express the ambiguity that defines the character of the norm: it represents at the same time fact and evaluation. It could be argued that it is this ambiguity *within* the norm that, when it is externalized, gives rise to a rather rigid distinction between norm and fact.

3.1.3 *A biological concept of the norm*

If it was the ideas of Kant and Nietzsche, respectively, that influenced the substance of Canguilhem's idea of a vital normativity, I argue that it was Goldstein who inspired Canguilhem to undertake the elaboration of a notion of the norm in relation to living processes. Goldstein had previously discussed the difference between the normal and the pathological in his own work and came to the conclusion that there was no satisfactory concept of the norm in relation to living processes. He observed that there are two main concepts of the norm: the 'idealistic norm concept' and the 'statistical concept of the norm'.¹⁰³

Neither of these concepts is of any use for the life sciences. The former because 'its frame of reference is not oriented on any reality but, rather, would have to justify itself in reality'.¹⁰⁴ It also fails to account for the specific individual form because it represents an ideal standard. The latter cannot do justice to the individual living process because it represents an average. According to Goldstein, what is required is a concept of the norm that is 'generally valid', that can - nevertheless - account for the individual form, and that - at the same time - 'should avoid the "subjective"'.¹⁰⁵

I argue that Canguilhem's idea of 'vital normativity' was intended to fulfil these almost impossible demands; it was intended to meet all three requirements. The notion of vital normativity is universally valid since it is applicable to all living processes without

¹⁰² Ibid.

¹⁰³ Goldstein (1995), p. 325.

¹⁰⁴ Ibid.

¹⁰⁵ Ibid.

exception. It, furthermore, operates at the level of the individual and can be regarded as the process that gives rise to the individual form as such. However, at the same time, it is not a norm that is employed by a subject as a standard of judgment or as a principle of understanding. Canguilhem's vital normativity represents the individual norm that Goldstein suggested the life sciences needed, but that he did not elaborate himself. The notion implies, as it did in Goldstein's work, that an individual cannot be regarded as normal or pathological with regard to an average or an ideal standard but only with regard to itself.¹⁰⁶

3.2 Canguilhem's 'vital normativity'

3.2.1 Normativity as '*technique*' of living

Kant referred to the 'lawlikeness' of the contingent in order to emphasize that the empirical diversity of living processes, even if described by reference to 'laws of nature',¹⁰⁷ could not be regarded as governed by rules or principles (of understanding). He did not claim anything regarding the nature of living processes but merely addressed the question if, and how, they could be understood. Canguilhem's idea of vital normativity is often regarded as describing the ontology of living processes. It is believed that he confused the distinction between norm and fact; he allegedly attributed normative status to factual living processes. Is Canguilhem directly attributing normativity to living processes? And if so, how might such a normativity be imagined?

Canguilhem's idea of normativity preserves an implicit reference to the traditional idea of the normative. However, I argue that it departs from such an idea in two important ways. First, it does not rely on the distinction between norm and fact. Second, Canguilhem's notion of normativity is not moral or ethical. I believe that Canguilhem draws on Nietzsche's idea of life as manifestation of an active and productive force and Kant's implicit suggestion of an immanent normativity of living processes that escapes principles of understanding. Canguilhem's idea of normativity, understood as *techniques* of living, does not merely propose a specifically biological concept of normativity. It introduces a completely different idea of the normative.

¹⁰⁶ Ibid., p. 329; Canguilhem (1978), p. 78.

¹⁰⁷ Kant uses the terms 'laws of nature' and 'empirical laws' (see Chapter 2, citations in paras. 1.2.1; 2.1.1; 2.2.1).

Canguilhem explains his idea of normativity as follows, referring to an article in '*Vocabulaire philosophique*' which

seems to assume that value can be attributed to a biological fact only by 'him who speaks', obviously a man. We, on the other hand, think that the fact that a living man reacts to a lesion, infection, functional anarchy by means of a disease, expresses the fundamental fact that life is not indifferent to the conditions in which it is possible, that life is polarity and thereby even an unconscious position of value; in short, life is in fact a normative activity.

Normative, in philosophy, means every judgment which evaluates or qualifies a fact in relation to a norm, but this mode of judgment is essentially subordinate to that which establishes norms. Normative, in the fullest sense of the word, is that which establishes norms. And it is in this sense that we plan to talk about biological normativity. We think that we are as careful as anyone as far as the tendency to fall into anthropomorphism is concerned. We do not ascribe a human content to vital norms but we do ask ourselves how normativity essential to human consciousness would be explained if it did not in some way exist in embryo in life.¹⁰⁸

Whereas Kant addressed the normativity of living processes primarily through the understanding and judgment of a subject, Canguilhem erases the subject from the equation and regards the human or the subject itself as a living process whose manner of living - or particular *technique* of life - consists of the way in which it engages with its environment through concepts.¹⁰⁹

It is apparent from Canguilhem's explanation of his notion of normativity that it does not concern an anthropomorphic idea of the norm.¹¹⁰ The idea of the norm as rule or principle facilitating understanding and judgment by a subject is revealed as merely one of the manifestations of a normativity that characterizes all living processes. This is an example of Canguilhem's particular method of a '*réversion*' through which he changes the assumed order of things (see Chapter 1, para. 2.1.5).

Canguilhem uses this method in order to remedy, what Bergson calls, an 'illusion of retroactivity'.¹¹¹ Bergson demonstrates how a particular kind of reason tends to reason 'backwards' - as it were - from the human subject and, therefore, necessarily results in anthropomorphism. Canguilhem believes that many of our terms and expressions in relation to life reveal such an 'illusion of retroactivity' and that this 'illusion' determines

¹⁰⁸ Canguilhem (1978), p. 70; Canguilhem (2006), p. 77, '*en germe dans la vie*' (was translated as 'in embryo in life').

¹⁰⁹ Foucault (1985), p. 12.

¹¹⁰ Canguilhem (1978), p. 4: Canguilhem notes in the Preface to the second edition that Bounoure (Faculty of Sciences at the University of Strasbourg) suggested - in response to the first edition of '*Le normal et le pathologique*' - that Canguilhem's idea of vital normativity can be regarded as a projection on nature of the human need to reach beyond itself.

¹¹¹ Ibid., p. 72.

our entire conception of the relation between the human and the vital. He gives the following example:

[T]he expressions 'natural selection' and 'natural medicinal activity' have one drawback in that they seem to set vital techniques within the framework of human techniques when it is the opposite which seems true. All human technique, including that of life, is set within life, that is, within an activity of information and assimilation of material. It is not because human technique is normative that vital technique is judged such by comparison. Because life is activity of information and assimilation it is the root of all technical activity ('*activité technique*').¹¹²

When Canguilhem describes life as lying at the root of all '*activité technique*', he does not mean technological activity in the modern sense of the word.¹¹³ Rather, he implies that the process of living represents a series of '*techniques*' that include human activities but that have - mistakenly - come to be defined as such.

The idea of life as processes or techniques, rather than as a value in itself, was explored by Nietzsche who observed that 'life is only a *means* to something; it is the expression of forms of the growth of power'.¹¹⁴ This does not mean that Canguilhem attributes no value to life; it just means that normativity does not represent 'the' value of life but the particular ways of confronting specific situations (a different 'value' is attributed each time). The idea of life as 'techniques' can be understood through Foucault's use of the term; *techniques* are practices that do not, in and of themselves, involve any 'moral reflection or prescription'.¹¹⁵

Rather, such techniques constitute the practices of living: the acting, selecting, informing that is necessary to confront the predicaments of life. As Canguilhem observes: 'even for an amoeba, living means preference and exclusion.'¹¹⁶ Such practices are not predetermined but are actualized each time, as Macherey says: 'Norms have no reality outside of the concrete action through which they effect and affirm their normative value against the obstacles that oppose this action.'¹¹⁷ It concerns 'the concrete movement of norms as vital schemes that are in search of the conditions of their realisation'.¹¹⁸

¹¹² Ibid.; Canguilhem (2006), p. 80.

¹¹³ Canguilhem (2003), pp. 129-164: Canguilhem explores this fundamental question through the familiar analogy between machine and organism.

¹¹⁴ Nietzsche (1968), p. 375.

¹¹⁵ Foucault (1990), p. 3 (in a different context); Foucault (1998), p. 141, on '*techniques* of power'; Foucault (1992), p. 11, on 'techniques of the self'.

¹¹⁶ Canguilhem (1978), p. 76.

¹¹⁷ Macherey (1998), p. 83 (my translation).

¹¹⁸ Ibid., p. 74 (my translation).

In what sense, then, are these techniques normative? They are not normative in a traditional sense that value is attached to them by a subject. Rather, they are normative in the sense that, as Canguilhem observes, ‘life is not indifferent to the conditions in which it is possible’.¹¹⁹ In other words, techniques of living are neither random nor predetermined but are driven by the particular necessities of living at a particular time and in a particular context. Normativity, therefore, signifies a potential; it cannot be equated with an individual living being. Any ‘*vivant*’ only ‘exists’ in the processes or techniques of living.

Normativity is often described as being ‘immanent’ in living processes.¹²⁰ This is often understood as meaning that norms are ‘in’ life and can be extracted from it. However, normativity is not a quality or quantity of life but a ‘*capacité*’¹²¹ to confront the predicaments of life. To suggest that normativity is always already actualized in living processes would take away the dynamic of the idea. As Macherey observes:

[T]he reference to vital norms obviously raises a problem: if these norms are interpreted as manifestations of a ‘*puissance*’ that is already entirely substantially constituted, then the dynamic that drives these norms is - in a way - halted, fixed in its origins where its successive manifestations are already prefigured; there would be no point then in speaking of the dynamic of life, but only of a dynamic of its manifestations, to which this metaphysical entity called ‘life’ would lend its support *a priori*.¹²²

The idea of normativity as potential that is not yet actualized implies a certain measure of contingency and possibility of change (of a normative order). Normativity is not contingent because - as Kant suggested - a norm is always exercised by a particular subject but because a norm represents the possibility of its own replacement:

[T]he norm, by devaluing everything that the reference to it prohibits from being considered normal, creates on its own the possibility of an inversion of terms. A norm offers itself as a possible mode of unifying diversity, resolving a difference (‘*résorption d’une différence*’), settling a disagreement (‘*règlement d’un différend*’). But to offer oneself is not to impose oneself. Unlike a law of nature, a norm does not necessitate its effect. That is to say, a norm has no significance as norm pure and simple. Because we are dealing with possibility only, that possibility of reference and regulation which the norm offers leaves room for another possibility, which can only be its opposite.¹²³

Nietzsche’s influence, especially his ideas on the ‘reversal of values’ and life as ‘self-overcoming’,¹²⁴ is perhaps most apparent here. Following Nietzsche, Goldstein - and Canguilhem after him - argues that in illness an organism does not seek to restore a

¹¹⁹ Canguilhem (1978), p. 70.

¹²⁰ Rose (1998), p. 164

¹²¹ Benmakhlouf (2008), p. 63.

¹²² Macherey (1998), p. 74 (my translation).

¹²³ Canguilhem (1978), p. 146-147; Canguilhem (2006), p. 177.

¹²⁴ Nietzsche (1971), p. 124; Deleuze (1983), p. 1.

previous state of health or normality. Rather, there is a 'reappearance of order'.¹²⁵ This means that illness or pathology does not represent a 'residue' of the normal but a different way of living.¹²⁶ Canguilhem describes a healthy 'normativity' as 'the possibility of transcending the norm, which defines the momentary normal, the possibility of tolerating infractions of the habitual norm and instituting new norms in new situations'.¹²⁷ It represents the potential to institute new norms and challenge existing normative regimes.

Since the normativity of living processes implies continuous transformation this means that the idea of deviation or exception from a rule or norm is not applicable to such processes. Canguilhem prefers to speak of infractions - rather than exceptions - that are, moreover, prior to the norm (rather than the other way around).¹²⁸ The living process cannot accommodate the idea of the exception because 'there is no room for fixed rules or norms, nothing from which an exception might be taken. All settlement is provisional, and the fundamental fact is the experience of particular disruptions and adaptations'.¹²⁹

When Canguilhem's idea of normativity is read primarily in light of his, and Foucault's, subsequent discussions on normalization¹³⁰ then the critical potential of this idea - and its dynamic or polemical character - is lost. It could, then, be said that normativity is normalized. Canguilhem associated the notion of normativity with the potential to change and challenge existing regimes and, therefore, with some sort of resistance or resilience. However, when normativity is - for example - regarded as the organization or function of an organism there seems to be no 'escape' from the norm.¹³¹ Canguilhem's idea of normativity indicates that there is no escape from normativity in the sense that there is no escape from the continuous demise and emergence of norms; any normative order is only temporary.

3.2.2 Social and vital norms

In his thesis on the normal and pathological, Canguilhem addresses biological normativity. Although there are implicit references to social understandings of the normative these do

¹²⁵ Goldstein (1995), p. 333.

¹²⁶ Canguilhem (1978), p. 110, citing Goldstein.

¹²⁷ Ibid., p. 115.

¹²⁸ Ibid., p. 123.

¹²⁹ Norris (2007), p. 33.

¹³⁰ N. Rose (1998), p. 164.

¹³¹ Huneman (2006), pp. 657-658.

not appear to form his main object of inquiry. Nevertheless, in the second edition of his book he added a short essay entitled '*du social au vital*'.¹³² In it, he addresses some questions that his thesis gave rise to regarding the relation - or distinction - between vital norms and social norms. This essay has perhaps mainly attracted attention because of Foucault's references to it (see para. 4.1.1 below). It also 'allowed for [Canguilhem's] assimilation, together with Michel Foucault, within a sociological critique of normalizing social control'.¹³³

Many have interpreted Canguilhem's essay as a discussion of a 'fundamental distinction' and 'a more or less complete opposition' between social and vital norms.¹³⁴ Its relevance has partly been attributed to a recent confusion between these two 'types' of norms, for example in relation to enhancement where 'error [is] open to correction in the name of a social, not a vital, norm of health'.¹³⁵ However, there seems to be some uncertainty about where the productivity of Canguilhem's ideas can be found. Is it in the idea of 'vital normativity' as such, in the inspiration that it provides for subsequent discussions on social norms and normalization, or in the distinction between 'social' and 'vital' norms itself?¹³⁶ I believe that this uncertainty is partly the result of a misinterpretation of Canguilhem's discussion on vital and social norms.

Canguilhem discusses the distinction between the social and the vital partly by reference to the difference in organization of society and organism.¹³⁷ However, I argue that this distinction is not what is most interesting about his essay. Canguilhem's discussion on social and vital norms should be regarded as an effort to refine his ideas on normativity and to spell out the consequences of a project of rationalization. Let us return to Canguilhem himself in order to clarify this.

In the Preface to the additional essays contained in the second edition of '*Le normal et le pathologique*', he explains his intentions with regard to the discussion on social and vital norms: 'it is only to clarify the specific meaning of vital norms by comparing them with social norms. It is with the organism in view that I am allowing myself some forays into

¹³² Canguilhem (2006), pp. 175-191; Canguilhem (1978), pp. 145-158.

¹³³ N. Rose (1998), p. 157.

¹³⁴ Ibid., pp. 157 and 164.

¹³⁵ N. Rose (2001), p. 19.

¹³⁶ See, e.g., N. Rose (1998), pp. 158 and 164: Rose changes positions on this question.

¹³⁷ Canguilhem (2006), pp. 186-191.

society.’¹³⁸ However, in the first edition of his thesis Canguilhem already refers to the relation between social and vital norms.

He argues that some phenomena, like height and even death, can be regarded as social and vital at the same time. For example, the average life span can be regarded as a social and biological phenomena because it includes the actions of man upon himself.¹³⁹ The social and the vital continuously refer to, and inform, each other. As Canguilhem observes: ‘in the human species, statistical frequency expresses not only vital but also social normativity. A human trait would not be normal because frequent but frequent because normal, that is, normative in one given kind of life’.¹⁴⁰

What function does this discussion of the mutual information of social and vital norms perform? Macherey suggests that Canguilhem ‘gives a dynamic to the notion of the norm from within; this is precisely what is at issue in the shift from a doctrine of the normal to a doctrine of the normative’.¹⁴¹ He notes that what gives normativity its dynamic character is how it articulates the implication of the social in the vital.¹⁴² What determines the normative character of normativity is the ‘historical-social’ structuring of life ‘in relation to its power to produce norms and not only submit to them’.¹⁴³

By playing with accepted notions of the normal and the normative, or the social and the vital, Canguilhem suggests a kind of ‘double action’ of the norm that drives his notion of normativity. Normativity, although - I argued - initially elaborated by reference to Goldstein’s idea of the individual norm, cannot be regarded solely by reference to an organic individual. Canguilhem suggested - for example - before such statements became fashionable, that ‘the human body is in one sense a product of social activity’.¹⁴⁴

The idea of the relation between the social and the vital as one of ‘norm upon norm’ resembles Nietzsche’s ideas of a ‘will upon will’.¹⁴⁵ It does not simply mean the imposition of one ‘type’ of norm over the other but signifies the way in which the effects of norms

¹³⁸ Canguilhem (1978), p. 142.

¹³⁹ Ibid., pp. 91-92.

¹⁴⁰ Ibid., p. 91.

¹⁴¹ Macherey (1998), p. 74 (my translation).

¹⁴² Macherey (1998), p. 76.

¹⁴³ Ibid., p. 78 (my translation).

¹⁴⁴ Canguilhem (1978), p. 91.

¹⁴⁵ Nietzsche (1968), p. 347.

contribute to, and intervene, in the production of norms.¹⁴⁶ As Macherey puts it, norms are at the same time '*normées et normantes*'.¹⁴⁷ This is probably a reference to Canguilhem's own statement that 'life is not only nature in the sense of "*nature naturée*" but also nature in the sense of "*nature naturante*".¹⁴⁸ It is this double identity of life and the norm, as that which is not just subjected or evaluated but is productive, that Canguilhem's idea of normativity envelops.

The double identity of the norm does not mean that biological normativity necessarily becomes socially normalized. In other words, it is not the case that - because the vital and the social are implicated in the idea of normativity - such normativity is necessarily subject to a particular exercise of the norm with regard to the living. It is only when the social and vital are regarded as radically separate that the living is understood merely as an object of judgment or understanding.

This is where the critical character of normativity is revealed. It challenges the traditional idea of the norm as standard or ideal by which life or lived experience is judged. Normalization appears as a consequence of a project of 'rationalization' that relies on such a traditional idea of the normative.¹⁴⁹ Canguilhem observes, apparently referring to Kant, that 'a norm offers itself as a possible mode of unifying diversity, resolving a difference (*'résorption d'une différence'*), settling a disagreement (*'règlement d'un différend'*)':¹⁵⁰

[A] norm, or rule, is what can be used to right, to square, to straighten. To set a norm (*normer*), to normalize, is to impose a requirement on an existence (*'une exigence à une existence'*), a given whose variety, disparity, with regard to the requirement, present themselves as a hostile, even more than an unknown, indeterminant.¹⁵¹

It is this critical aspect of normativity that appears in Canguilhem's discussion on social and vital norms that Foucault picks up on in his work on normalization.

¹⁴⁶ Macherey (1998), p. 77.

¹⁴⁷ Ibid., p. 78.

¹⁴⁸ Canguilhem (2002), p. 352; See also Canguilhem (1976).

¹⁴⁹ Canguilhem (1978), p. 145.

¹⁵⁰ Ibid., p. 147.

¹⁵¹ Ibid., p. 146.; Canguilhem (2006), p. 177.

PART IV

4.1 Normativity: 'biopower' and 'contingency'

4.1.1 Foucault's 'biopower'

The most important influence of Canguilhem on the work of Foucault is believed to be his work on the normal and the pathological. Foucault elaborated his ideas on normalization by reference to this work. Foucault himself described Canguilhem's influence in one of his lectures on the 'abnormal':

[A] few words more, if you will allow me a few minutes. I would like to say this, I would like to refer you to a text that is found in the second edition of Georges Canguilhem's book *On the Normal and the Pathological* (starting on page 145). In this text on the norm and normalization, there is a set of ideas that seem to me to be both historically and methodologically fruitful. First of all, Canguilhem refers to the development in the eighteenth century of a general process of social, political, and technical normalization that takes effect in the domain of education, with the school; in medicine, with hospital organization; and also in the domain of industrial production. The army could no doubt be added to this list. So we have a general process of normalization during the eighteenth century and the multiplication of its effects regarding childhood, the army, production, and so forth.¹⁵²

He goes on to say:

[I]n the same text there is also the important idea that *the norm is not at all defined as a natural law* but rather by the exacting and coercive role it can perform in the domains in which it is applied. The norm consequently lays claim to power. *The norm is not simply and not even a principle of intelligibility*; it is an element on the basis of which a certain exercise of power is founded and legitimized. Canguilhem calls it a polemical concept. Perhaps we could say it is a political concept. In any case - and this is the third important idea - the norm brings with it a principle of both qualification and correction. The norm's function is not to exclude and reject. Rather, it is always linked to a positive technique of intervention and transformation, to a sort of normative project. It is this set of ideas, this simultaneously positive, technical, and political conception of normalization that I would like to try to put to work historically.¹⁵³ (Emphasis added)

Foucault identifies the particular character of Canguilhem's idea of the norm and the way in which it differs from traditional interpretations: the norm is not a principle of intelligibility or a natural law. These were the only two ways in which the normative was conceived of by Kant in relation to living processes and the empirical world generally; as the *a priori* principle by which the world could be understood or as a diversity of empirical laws.

¹⁵² Foucault (2003), p. 49.

¹⁵³ Ibid., p. 50.

Although Foucault recognizes the active or positive aspects of normativity that Canguilhem describes, he returns in his work to the idea of the norm as that which is used to ‘qualify, measure, appraise, and hierarchize’¹⁵⁴ thereby representing the norm as being ‘among the arts of judgment’.¹⁵⁵ Rouse observes:

Foucault most often discussed normalization as a technique of power, but its epistemic implications emerged clearly in his account. Normalizing judgment produced: ‘a whole range of degrees of normality indicating membership of a homogeneous social body but also playing a part in classification, hierarchization and the distribution of rank. In a sense, the power of normalization imposes homogeneity; but it individualizes by making it possible to measure gaps, to determine levels, to fix specialties and to render the differences useful by fitting them one to another’.¹⁵⁶

Foucault’s account of the normative and normalization is arguably more about the judgment of normality and the control made possible by such judgment than about the idea of a normativity that challenges and escapes judgment - as, I have argued, Canguilhem proposes.

To some extent, Canguilhem’s own focus on the centrality of error and the ‘existential priority’¹⁵⁷ of the abnormal with regard to living processes invites the idea of normalization as correction. Leblanc observes that ‘the primary role of the abnormal ... invites the requirement of correction. The norm becomes a principle of correction, of rectification or of assimilation’.¹⁵⁸ However, Canguilhem regarded normalization as a process that is inherently ‘anthropological’ or ‘cultural’¹⁵⁹ as opposed to normativity, which he associated with life in general rather than with human existence.

It could be argued that Foucault’s earlier focus on norms and normalization as ‘technical’ or ‘political’ concepts is farther removed from the more polemical idea of the norm that both Nietzsche and Canguilhem propose. Gillian Rose, for example, observes how Foucault’s representation of ‘right as technique, law as normalization, punishment as control ... translat[es] what he takes to be political concepts ... into neutral, scientific concepts’.¹⁶⁰ Foucault’s suggestion, in the citation above, that Canguilhem’s ‘polemical’ idea of the norm can also be regarded as a ‘political’ notion is significant in this regard. Rather than providing the idea of normalization with additional critical potential, its

¹⁵⁴ Foucault (1998), p. 144.

¹⁵⁵ Ewald (1990), p. 139.

¹⁵⁶ Rouse (1994), p. 98, citing Foucault.

¹⁵⁷ Canguilhem (1978), p. 149.

¹⁵⁸ Leblanc (1998), p. 19 (my translation).

¹⁵⁹ Canguilhem (1978), p. 147.

¹⁶⁰ G. Rose (1984), p. 192, referring to Foucault’s particular sociological thought.

representation as a 'political' notion arguably weakens the association with power, resistance, and the change of order that both Nietzsche's idea of 'will to power' and Canguilhem's 'vital normativity' express.

Since most attention has been paid to the influence of Canguilhem's work on Foucault's ideas on normalization, the influence of his notion of 'vital normativity' on Foucault's idea of 'biopower' is often overlooked. I argue that in his notion of 'biopower', Foucault recaptures the normative commitment that gave rise to the elaboration of Canguilhem's original idea of normativity: a commitment to challenge the applicability of a certain type of rationality to life and the recognition of the potential of life to transform traditional understandings of knowledge and power. As Deleuze observes with regard to Foucault's notion of 'biopower':

[L]ife becomes resistance to power when power takes life as its object. Here again, the two operations belong to the same horizon ... When power becomes bio-power, resistance becomes the power of life, a vital power that cannot be confined within species, environment or the paths of a particular diagram.¹⁶¹

Whereas in Foucault's previous work the emphasis seemed to be on norms and rules imposed by institutions on life and perpetuated by certain practices, the emphasis has now shifted to the idea of power as *techniques* of life that resist the traditional imposition of norms by a subject. In Foucault's later work, normalization is represented more as a consequence rather than as the main object of inquiry. The main object of inquiry is the transformation of power, or the emergence of a different kind of power, that has as its consequence a shift from a primarily repressive regime of sovereign authority and juridical rule to a productive regime of norms and normalization.

4.1.2 Normativity and contingency

Canguilhem's notion of normativity seems radically contingent. Normativity can neither be equated with the organization of living processes nor with their functioning; the techniques of living are themselves functionally contingent in the sense that all operations are themselves continuously subject to change. Canguilhem also emphasizes the centrality of error in relation to living processes, which implies a continuous correction and rectification. It means that all solutions to the problems that are thrown up by the predicaments of living

¹⁶¹ Deleuze (1999), p. 77.

are necessarily provisional. The association of normativity with contingency is also present, if implicitly, in Foucault's idea of biopower because power is not concentrated in - or exercised by - a person but emerges from 'actions upon actions'.¹⁶²

Canguilhem's idea of normativity as contingency may seem like a useful theoretical instrument for the contemporary life sciences with their frequent, although often undefined and implicit, references to emergence and contingency. It has, for example, been noted that the contemporary life sciences can be characterized by how 'the biological ... has, in a sense, become a wholly contingent condition'.¹⁶³ This implies that living processes have only recently become contingent, or at least more contingent than they were before, because of technological developments that allow for their fragmentation and mobilization. However, the association of living processes with contingency is not distinctive of the twentieth or twenty-first century. In order to assess the productivity of Canguilhem's idea of normativity it is necessary to put the idea of 'contingency' into context.

Kant characterized living processes by reference to the contingency and diversity of natural laws. He argued that in order for contingency to be understood as such, i.e. as contingent, it was necessary to unify empirical diversity.¹⁶⁴ The contingency of living processes could only be made intelligible by regarding organisms as 'unities of diversity' and by reference to the principle of a 'lawlikeness of the contingent' (see Chapter 2). Although this paradoxical principle of the 'lawlikeness of the contingent' seems to straddle norm and fact, Kant regarded the realm of understanding and experience as radically separate.

Canguilhem points out, probably with Kant in mind, that the representation of living processes as initially 'lawless' - or as a diversity that borders on chaos - has a specific aim. Kant's introduction of a systematic theory that relies on rules and principles brings order to this chaos. It empowers human subjects and makes it possible for them to judge, manipulate, and intervene in living processes. Canguilhem observes:

[T]he instability of things has as its correlative the impotence of man. The image of chaos is that of a denied regularity, as that of the golden age is that of wild [*sauvage*] regularity. Chaos and golden age are the mythical terms of the fundamental normative relation.¹⁶⁵

¹⁶² Pottage (1998b), p. 4.

¹⁶³ Franklin (2003), p. 100.

¹⁶⁴ See Zuckert (2007), pp. 13-14.

¹⁶⁵ Canguilhem (1978), p. 148.

It is this empirical chaos that necessitates a systematic notion of reason and of the normative. The idea of chaos without regularity, or the empirical diversity of nature without unification, anticipates regularization or unification. Since such chaos will never cease to proliferate, the traditional notion of the normative continues to hold sway. However, Canguilhem believes that such a '*régularité sauvage*' is ultimately doomed for mediocrity; it cannot be maintained without being tested and challenged.¹⁶⁶

Whereas Kant regarded his own system of understanding as constantly under threat from 'ontic complexity' or the empirical diversity of living processes, what seems to define contemporary biology is the embrace of such contingency and diversity (at least epistemologically).¹⁶⁷ As Jacob observed, 'it is ... on contingency that the unity of explanation is based today'.¹⁶⁸ It should, of course, be pointed out that there are many understandings of 'contingency'. It can, for example, be understood as epistemic, ontological, or more generally as a notion that signifies how traditional terms - such as 'action' and 'causality' - are no longer valid.¹⁶⁹ Kant's references to contingency cannot necessarily be equated with contemporary references to contingency or 'complexity'.

Nevertheless, Canguilhem's notion of vital normativity may be useful because it identifies the contingency of living processes epistemologically. The notion of a biological normativity provides an alternative to Kant's idea of the subjection or unification of the diversity of living processes to a principle of 'lawlikeness' in order to make them intelligible. It represents the idea that contingency is not necessarily something that can be made intelligible through unification, as Kant suggested. Rather, the notion of normativity suggests that living processes cannot be grasped by Kant's system of understanding and judgment at all.

¹⁶⁶ Ibid.: 'the order of the golden age cannot last because wild regularity is mediocrity ; the satisfactions there are modest - *aurea mediocritas* ... Where a rule is obeyed without awareness of a possible transcendence, all enjoyment is simple. But can one simply enjoy the value of the rule itself? In order to truly enjoy the value of the rule, the value of regulation, the value of valorization, the rule must be subjected to the test of dispute'.

¹⁶⁷ Rheinberger (1997b), p. S247: 'If ontic complexity has to be reduced in order to make experimental research possible, this very complexity is epistemically retained.'

¹⁶⁸ Jacob (1976), p. 323.

¹⁶⁹ See Oyama (2000), p. 116, for the difference between ontological contingency ('causal dependency') and epistemological contingency ('unpredictability'); Pottage (1998b), p. 17: 'Because contingency excludes any model of hierarchy, or centre and periphery, and because it disqualifies structures and subjects (or any form of master-principle), as appropriate units of theoretical analysis, the anchoring points of causal analysis are dissolved.'

I do not argue that a general shift can be perceived in contemporary biology from regularity to irregularity or contingency;¹⁷⁰ or to a kind of ‘irregularity without a concept’ or ‘multiplicity without a rule’.¹⁷¹ Too much focus on contingency or on what could be called the ‘lawlessness of the contingent’ would obscure the fact that living processes are not ‘lawless’. They are contingent mainly by reference to the norms, laws, or regularity imposed by a subject. Canguilhem suggests that living processes are very much driven by regularities; he cites I. Geoffroy Saint-Hilaire: ‘there are no organic formations which are not subject to laws; and the word *disorder*, taken in its real sense, would not be applicable to any productions of nature.’¹⁷² Living processes are not defined by their disorder; that which is regarded as disorder is merely the substitution of a previous order.¹⁷³

Luhmann, like Foucault,¹⁷⁴ interprets the growing reliance on contingency as a characteristic of modernity.¹⁷⁵ Although references to contingency often imply a ‘break’ from a rationality based on principles and rules, objects and subjects, Luhmann notes: ‘The reference to contingency is so instinctive that it is a part of any search for necessity, for validity *a priori*, for inviolate values.’¹⁷⁶ Contingency, then, emerges not so much as a ‘new’ theoretical form but as a logical correlate of a rationality that is at least two centuries old.

Foucault and Luhmann approach the idea of contingency differently. The former does not focus on the form of contingency as such - although it arguably informs his discussions on power -¹⁷⁷ but believes that what characterizes modernity is a certain ‘attitude’ adopted towards contingency.¹⁷⁸ Luhmann, like Foucault, does not attach any kind of value judgment to the modern reliance on contingency. He asks the more practical question: ‘is there a *theory* that can make use of the *concept* of contingency?’¹⁷⁹ I argue that Luhmann’s own systems theory is meant to provide the affirmative answer to this question. What

¹⁷⁰ Cf. Rheinberger (1997a), p. 16: ‘The concept of heredity did not result from a growing attention to mere similarities between parents and offspring, from an obsession of the scientific mind with regularity at the expense of contingency and complexity.’

¹⁷¹ G. Rose (1984), p. 2, referring to Deleuze’s idea of ‘repetition’ and Foucault’s idea of ‘power’, respectively.

¹⁷² Canguilhem (1978), p. 74.

¹⁷³ Ibid., p. 113.

¹⁷⁴ Foucault (1984), p. 39, referring to Baudelaire who defined modernity as ‘the ephemeral, the fleeting, the contingent’.

¹⁷⁵ Luhmann (1998), p. 44.

¹⁷⁶ Ibid.

¹⁷⁷ Pottage (1998b), p. 4.

¹⁷⁸ Foucault (1984), p. 39, referring to Baudelaire: ‘But, for him, being modern does not lie in recognizing and accepting this perpetual movement; on the contrary, it lies in adopting a certain attitude with respect to this movement.’ Foucault describes this ‘attitude’ as ‘a mode of relating to contemporary reality’ or an ‘ethos’.

¹⁷⁹ Luhmann (1998), p. 46; see also Pottage (1998b), p. 2.

makes it possible for Luhmann to shift from a focus on ontology and 'substance' to 'emergence' is the idea that structures and processes 'produce themselves out of their own contingency'.¹⁸⁰ The emergence of systems or processes presupposes the production and reduction of complexity (see Chapter 3 on the role played by 'environment').¹⁸¹

Luhmann's description of the emergence and operations of systems is similar to Canguilhem's description of normativity in relation to the living: both represent techniques of continuous production and transformation. It could be argued that Canguilhem's 'normativity' is Luhmann's 'differentiation'; that which continuously gives rise to new articulations of the distinction between organism - or system - and environment. As Pottage observes:

[T]he 'being' of systems is therefore processual in the sense that they exist only in and through the operations that articulate their elements. These operations are continually renewed; they articulate events, elements that become fully saturated, and die away with each operation, remaining only as a prompting memory for future operations ... In this way the system reproduces itself from operation to operation.¹⁸²

In Luhmann's work, contingency is not only temporal because operations operate in time and normative orders appear and disappear, it is also epistemic because operations cannot be predicted. He defines contingency as that which is 'neither necessary nor impossible.'¹⁸³ Since contingency cannot be grasped by a binary logic that relies on the ontology of 'being/non-being', a 'third value of undeterminability' is introduced.¹⁸⁴

The introduction of undeterminability into a theory that relies on time results in a focus on probability. Luhmann observes, '[i]n the dimension of time, the present refers to a future that only exists as what is probable or improbable ... The present can calculate a future that can always turn out otherwise.'¹⁸⁵ The contingency that the notion of probability represents is explained by Luhmann, without direct reference to Canguilhem, by reference to the improbability of normality:

[W]hat is at issue here is ... first and foremost an analytic interest: to break through the illusion of normality ... The methodological recipe for this is to seek theories that can succeed in explaining the normal as improbable. From the functionalistic perspective, this can occur with the help of problem

¹⁸⁰ Pottage (1998b), p. 3.

¹⁸¹ Ibid.

¹⁸² Ibid., p. 4.

¹⁸³ Luhmann (1998), p. 45.

¹⁸⁴ Ibid., p.46.

¹⁸⁵ Ibid., pp. 69-70.

formulations that make it possible to represent the normal experiential contents of the life world as an already-successful solution to the problem, but one that could also, perhaps, be otherwise.¹⁸⁶

Although Luhmann's description of the operations of systems and their temporal transformations is reminiscent of Canguilhem's description of normativity in terms of techniques of living, Luhmann shies away from using the concept of the norm or normativity in relation to contingency. He proposes to accept the notion of the norm only in a 'theoretically secondary, derivative position'.¹⁸⁷ This does not mean that norms are socially insignificant; it just means that they should not be used for 'norm-immanent generalizations'.¹⁸⁸

By not attributing primary theoretical significance to the norm or normativity, Luhmann seeks to distinguish himself from traditional social theory that relies on 'normative presuppositions' to explain social order.¹⁸⁹ He, therefore, espouses a traditional idea of the normative. Canguilhem's idea of normativity as contingent techniques that are ad hoc and productive represents an alternative to such traditional ideas. Normativity becomes an epistemological instrument. It is not merely a '*concept* of contingency',¹⁹⁰ but accounts for the 'conception of concepts'.¹⁹¹ The difference between Luhmann and Canguilhem is that, whereas the former seeks to propose a *theory* in which a concept of contingency might be useful, Canguilhem recognizes that any concept of contingency is only truly useful when it is divorced from a theory that generalizes or rationalizes it.

CONCLUSION

The normative in relation to the life sciences is usually understood as moral judgment; it is largely determined by the distinction between norm and fact. I have argued that, although Canguilhem's notion of 'vital normativity' is often regarded as obsolete, this notion has contemporary significance for the life and social sciences. It is usually understood as a vitalist principle that describes the ontology of the living. However, its original significance can only be understood when the history of the notion is taken into account.

¹⁸⁶ Luhmann (1996), p. 114.

¹⁸⁷ Ibid., p. 325.

¹⁸⁸ Ibid., p. 326.

¹⁸⁹ Ibid., p. 325.

¹⁹⁰ Luhmann (1998), p. 46.

¹⁹¹ Canguilhem (2002), p. 344.

I have argued that the main inspirations for Canguilhem's notion of normativity were Kant's views on the normative in relation to living processes and Nietzsche's idea of 'will to power'. I have argued that Canguilhem elaborated his notion of the normative in response to Goldstein's suggestion that no specific concept of the norm exists in relation to living processes. Canguilhem developed his idea of biological normativity by reference to the distinction between the normal and the pathological in medicine and by relying on the inherent ambiguity of the norm.

He developed an entirely new idea of the normative by representing normativity as the contingent '*techniques*' of living that defy the application or imposition of a norm to the living by a subject. Foucault recovered this idea of the techniques or power of life in his notion of 'biopower'. I have argued that biopower does not signify a way of exercising power 'over' life, but represents Foucault's effort to think how taking life into account transforms traditional notions of knowledge and power. This project was previously undertaken by Nietzsche and Canguilhem.

I have contrasted the contingency of Canguilhem's notion of normativity with Luhmann's systems theory, which relies on a similar contingency. Luhmann observed how contingency is an essential aspect of modern rationality. However, Kant believed that the contingency of living processes could only be made intelligible as such by unifying that contingency. I have argued that Canguilhem's notion of normativity cannot be unified into a 'concept of contingency' but represents a useful theoretical instrument at a time when the contemporary life sciences seem to embrace the epistemological contingency and complexity of living processes.

7. CONCLUSION

The rapid developments in the life sciences seem to concentrate the focus of most inquiries in the social sciences on keeping up with such developments; on trying to understand them and describe them correctly. This means that a certain kind of theorizing has been lost or has come to be regarded as obsolete. Canguilhem's work, written in a different style and in a different period, no longer seems very relevant for the contemporary life sciences.

I have argued that Canguilhem's work is useful for both the life and social sciences because he asks some particularly pertinent questions. I have argued that the significance of his work must be sought in how he engages with modern rationality; with the particular 'metaphysics' that grounds the contemporary life and social sciences. My intention has not been to evaluate this rationality but merely to understand how it has been constituted and what the role of the life sciences has been in such constitution.

The productivity of Canguilhem's work lies, more specifically, in his inquiry into concepts that he sometimes refers to as 'categories'. They could also be called paradigms or 'second-order' concepts. I have argued that what is at issue is not necessarily a crossing over of concepts from the social to the vital, or the other way around. Rather, these concepts migrate regardless of boundaries; epistemological or otherwise. They represent some of the basic epistemological or discursive forms that are characteristic of the kind of rationality that Canguilhem seeks to question.

Apart from the traditional features of concepts, such as their indeterminacy and mobility, what characterizes Canguilhem's focus on concepts is that he regards them as 'preserved problems'. His intention is to unpack, reveal, and open up a problem; not to solve it. He inquires into what makes a problem durable and at the same time malleable enough to transform each time. Canguilhem reveals that an important aspect of concepts is their vitality; the way in which they evolve and mutate. A concept cannot merely be understood as an instrument of reason or understanding. It is not just a cognitive operator, but integrates values. An inquiry into concepts, therefore, necessarily reveals a normative project.

The metaphysics of modern rationality, I have argued, is constituted partly through Kant's architecture of a particular relation between knowledge and life. Although this foundation may be presupposed by contemporary inquiries, it is productive to recognize this heritage in order to identify how certain problems or questions persist in the life sciences. The question that Canguilhem asks, and that already represented a theme in Nietzsche's work, is: what happens when life becomes subject? In other words, what happens to this constitution of modern rationality when life is introduced into - rather than divorced from - the processes of knowledge and power?

I have chosen to focus on Canguilhem's engagement with various German philosophers and scientists (or scientist-philosophers) rather than with the more familiar French predecessors and contemporaries. This particular influence on Canguilhem - and on other French philosophers - has not been sufficiently explored; I believe that it is crucial to understand what Canguilhem was doing. His engagement can be called 'lateral' and his references often remain implicit. However, I have argued that Canguilhem's work can be read in some ways as a critique of *Critique*. I have referred to Foucault's work mainly in order to explore his suggestion that Canguilhem should be read as engaging with modern rationality.

Many inquiries in the social sciences in relation to the life sciences start from a certain assumption, namely, that at a certain point in time a transition took place that made life relevant to processes of knowledge or that living processes somehow became political. Although Foucault alluded to this transition, he did not explore it in much detail. I have argued that this transition can be associated with the particular way in which Kant included living processes in his theory of understanding by excluding them, thereby establishing a relation between knowledge and life that continues to haunt the life and social sciences.

Although it is surely impossible to identify modern rationality by reference to one particular point in time or one single occurrence, Kant's elaboration of his first and third *Critique* established a relation that has - arguably - become characteristic of modern rationality. I have argued that Kant includes living processes into his theory of reason through his epigenesis analogy but that he subsequently excludes such processes through his idea of a lawlikeness of the contingent. The latter was intended to, paradoxically, conceptualize the diverse as diverse by regarding it as a unity. This figure of the 'unity of

diversity' was, I have argued, a predecessor of the '*unitas multiplex*' that is used by Luhmann in order to conceptualize heterogeneous processes of differentiation.

The exclusion - through inclusion - of life from knowledge represented, I have argued, Kant's negotiation of the historicity and vitality of his *a priori*. Canguilhem believes that the exclusion of living processes from understanding reveals the limits of Kant's critical project. In any case, ever since Kant, life has come to be regarded as at the same time the limit and condition of possibility of knowledge.

The first concept that was addressed in order to explore Canguilhem's engagement with modern rationality was the notion of environment or 'milieu'. In contemporary biology the idea of environment is being reconceptualised but many proceed by dismissing the traditional concept of environment altogether. Canguilhem asks the question what role is left for the notion of environment when the life sciences traditionally focus on the individual. However, rather than dismiss the notion he believes that it has come to constitute a 'category of contemporary thought'. He does not assume the traditional, and arguably less productive, interpretations of environment as location, resource, or term in a relationship. Rather, I have argued that he turns the environment into a 'category' in order to explore what it *does* as a figure of thought.

Canguilhem notes that a biological concept of environment does not exist. The concept of environment first emerged in Newton's physics. He returns to Newton's original idea of 'milieu' as medium in order to reveal its productive ambiguity. I have argued that aether, conceived as milieu, was employed by Newton in order to introduce dynamics into traditional mechanical philosophy. The milieu made his idea of forces and action at a distance possible. It unseated the privileged role of the individual particle in motion. It was, as Canguilhem points out, - ironically - biology rather than physics that turned the environment into a static space or a 'physical fact'.

Another important reconceptualization of environment was Bernard's notion of the internal milieu. This idea recovered the ambiguity of Newton's original notion of milieu. It was used by Bernard in order to explain his idea of the 'double condition of existence' and the self-regulation of living processes. As Canguilhem notes, the notion of the internal milieu 'broke' the circularity of the perception of the organism by reference to the whole/part distinction. Von Uexküll's idea of *Umwelt* represented another innovation of the concept of

environment. It was not regarded as a location but as a network or interconnection of various signals and perceptual cues.

I have argued that Luhmann's use of environment in his social theory was influenced, at least to some extent, by Canguilhem's discussion of 'milieu'. The central role that is attributed to the environment in Luhmann's theory made it possible for him to shift from a focus on ontologies to a focus on processes of differentiation. It makes his idea of the autopoietic reproduction of systems as 'subject-free' action possible. Here, the notion of environment again recovers its original ambiguity and association with action that is not directly attributable to a centre. I have argued that the environment remains a purposefully vague notion in Luhmann's work in order to fulfil its function as a non-foundational presupposition.

I have argued that Canguilhem regarded the changing role of the environment as indicative of, and corresponding with, a shift in rationalities; from a vision of the world where man is at the centre of the cosmos to man being at the centre of his own understanding. As Canguilhem observes, the focus on 'milieu' indicates that man - as centre - is but one milieu among many. The focus on environment, if it is not regarded as location or resource, makes it possible to question privileged centres of reference and introduces a certain measure of contingency. It, therefore, opens up the possibility of a different rationality.

The next concept that I have addressed was that of individuality in the life sciences. The individual represents the traditional focus of inquiry in the life and social sciences. Recently, the individual seems to have disappeared through technological developments. However, at the same time individuality recurs as a question through references to various processes of individuation. The theoretical question posed by the focus on individuality in the life and social sciences is largely left unaddressed.

I have argued that Canguilhem's discussion of the history of the concept of the cell does not concern an inquiry into the ontology of the individual. In other words, his main concern is not, as has been suggested, to assess what counts as an individual form in the life sciences. Rather, I argued that Canguilhem uses the history of the concept of the cell in order to inquire into, what he called, the 'problem of individuality'. The cell as individual form represents at the same time a manifestation of individuality and it provides the

possibility of inquiring into the wider historical and social problematic that individuality represents.

Not much attention has been given to the various aspects of individuality that Canguilhem discussed. For example, he described the individual as emerging from a long-running debate about continuity and discontinuity in the life sciences. The idea of the individual as a 'discontinuous continuity' explains how individuality always seems to extend beyond the individual form and how it re-emerges in various guises. Canguilhem, furthermore, addresses the imagery associated with the cell in order to reveal the emotions and affections that determine the idea of the individual. His alternative reading of the emergence of the individual in political philosophy, as a cooperative effort rather than as a singular entity, reveals that the focus on individuality is indicative of certain normative assumptions and of a commitment to a particular kind of rationality or ideology.

I contrasted Kant's association of individuality with unity, identity, and autonomy with Nietzsche's idea of a process of self-overcoming. More recent interpretations of individuality as process were discussed by reference to Simondon's inquiry into processes of individuation in the life and physical sciences, Foucault's elaboration of individuality as the form of the '*rapport à soi*', and Luhmann's idea of individuality as the distinction of unity or differentiation. Such ideas on individuality and its inherent transformation seem to represent manifestations, as well as criticisms, of modern rationality and its continuous focus on the individual form.

Canguilhem's discussion of the 'problem of individuality', and of the individual as a form that migrates across disciplines, regains relevance at a time when individual entities and processes seem to proliferate and the privileged individual of the gene is replaced by notions such as system, network, and pathway; all of which challenge and perpetuate the problem of individuality in the life sciences.

The next concept that I have addressed was that of information. This was a prominent notion in the life and social sciences a few decades ago and many substantial changes have been attributed to it. However, its productivity as a metaphor has been questioned as well as the way in which it helped to consolidate some perhaps unhelpful distinctions - such as individual/environment and form/matter. The introduction of the notion of information into the life sciences has also been associated with new ways of controlling living processes. I

have argued that, although Canguilhem's discussion on information is usually dismissed as largely irrelevant, it forms an important part of his engagement with modern rationality. He employs the idea specifically in order to reconceptualize the relation between knowledge and life that Kant established.

In order to contrast Canguilhem's ideas with the most common discussions of the concept of information in the life sciences, I have first described how many rely on the form/matter distinction and regard information as a reincarnation of Aristotelian form. However, it often goes unnoticed that Aristotle elaborated his notion of form precisely in order to challenge the form/matter distinction. The fact that his idea of form has been appropriated by almost everyone shows that the Aristotelian form has many forms.

Canguilhem seems to adopt Aristotle's idea of form understood as an active principle and a process of actualization of potentiality. He believes that the notion of information can be used to illustrate that the process of knowing is a technique of living, thereby undermining the distinction between the two regimes of understanding and experience that Kant established. The notion of information also realizes the shared project of Bachelard and Canguilhem to reveal how error - rather than truth - lies at the heart of knowledge.

Finally, I have addressed Canguilhem's idea of normativity. This idea is mostly regarded as describing the organic ontology of living beings and is often regarded as having become obsolete. I have argued that Canguilhem elaborated his idea of a biological normativity following Goldstein's complaint that there was nothing besides the traditional idealistic and statistical concept of the norm in relation to living processes and that both these concepts were inadequate.

Canguilhem elaborates his notion of normativity in relation to the distinction between the normal and pathological that had previously occupied Goldstein. He uses the inherent ambiguity of the norm in order to elaborate an entirely new idea of the normative. I have argued that he used Kant's implicit suggestion of an immanent normativity of the living as well as Nietzsche's idea of life as a manifestation of 'will to power' as inspiration for his notion of 'vital normativity'.

I have argued that Canguilhem's normativity is not moral or ethical and cannot be understood with reference to the distinction between norm and fact. Rather, normativity is

understood as the techniques of living that imply a certain resistance to the traditional idea of the norm as judgment exercised by a subject over living processes. Canguilhem's idea of normativity reveals how normalization is a consequence of a particular project of rationalization. Although the notion of normativity is not a moral notion, it expresses Canguilhem's normative project of questioning modern rationality. I have also argued that his notion of normativity can be regarded as a helpful theoretical instrument or epistemological figure to think about the contingency of living processes. As opposed to Kant's idea of the 'unity of diversity', the notion of normativity indicates that it is no longer necessary to unify the contingency of living processes in order for such contingency to be understood.

BIBLIOGRAPHY

- Agamben, G. (1998) *Homo Sacer: Sovereign Power and Bare Life* [*Homo sacer: Il potere sovrano e la nuda vita*, 1995], trans. D. Heller-Roazen, Stanford: Stanford University Press.
- (2004) *The Open – Man and Animal* [*L'aperto. L'uomo e l'animale*, 2002], trans. K. Attell, Stanford : Stanford University Press.
- (2008) *Signatura rerum - sur la méthode* [*Signatura rerum. Sul metodo*, 2008], trans. J. Gayraud, Paris: Vrin.
- Arendt, H. (1998) *The Human Condition* [1958], Chicago: University of Chicago Press.
- Aristotle (1986) *De Anima*, trans. H. Lawson-Tancred, London: Penguin.
- (1987) *On the Parts of Animals*, trans. W. Ogle, New York: Garland Publishing.
- (1998) *Metaphysics*, trans. H. Lawson-Tancred, London: Penguin.
- Atlan, H. (1995) 'Biological Medicine and the Survival of the Person', *Science in Context* 8, pp. 265-277.
- Bachelard, G. (1970) 'Critique préliminaire du concept de frontière épistémologique', in G. Canguilhem (ed.) *Gaston Bachelard - Etudes*, Paris: Vrin, pp. 77-85.
- Badiou, A. (1998a) 'Is There a Theory of the Subject in Georges Canguilhem?' [Y a-t-il une théorie du sujet chez Georges Canguilhem?, 1993], trans. G. Burchell, *Economy and Society* 27: 2&3, pp. 225-233.
- (1998b) *Court traité d'ontologie transitoire*, Paris: Seuil.
- Balibar, E., Cardot, M. Duroux, F. et al. (eds.) (1993) *Georges Canguilhem - philosophe, historien des sciences*, Paris: Albin Michel.
- Barthélémy, J.-H. (2005) *Penser l'individuation - Simondon et la philosophie de la nature*, Paris: l'Harmattan.
- Bayatrizi, Z. (2008) 'From Fate to Risk: the quantification of mortality in early modern statistics', *Theory, Culture & Society* 25:1, pp. 121-143.
- Benmakhlouf, A. (2008) 'Canguilhem, la capacité normative', in G. LeBlanc (ed.) *Lectures de Canguilhem - le normal et le pathologique*, Lyon: ENS, pp. 63-83.
- Bateson, G. (2000) *Steps to an Ecology of Mind: collected essays in anthropology, psychiatry, evolution, and epistemology* [1972], Chicago: University of Chicago Press.

- Bensaude-Vincent, B. (1998) *Eloge du mixte - matériaux nouveaux et philosophie ancienne*, Paris: Hachette.
- Bergson, H. (1908) *L'évolution créatrice* [1907], Paris: Felix Alcan.
- (1975) *Creative Evolution* [*L'évolution créatrice*, 1907], trans. A. Mitchell, Westport: Greenwood Press.
- Bernard, C. (1865) *Introduction à l'étude de la médecine expérimentale*, Paris: J.B. Bailliere et fils.
- (1965) *Cahier de notes, 1850-1860*, M.D. Grmek (ed.), Paris: Gallimard.
- (1966) *Leçons sur les phénomènes de la vie communs aux animaux et aux végétaux* [1878], Paris: Vrin.
- Bing, F., Braunstein, J-F and Roudinesco, E. (eds.) (1998) *Actualité de Georges Canguilhem - Le normal et le pathologique*, Paris: Synthélabo.
- Bourdieu, P. (1985) 'The Genesis of the Concepts of Habitus and of Field', *Sociocriticism* 2, pp. 11-24.
- (1998) 'Georges Canguilhem: an obituary notice, trans. G. Burchell, *Economy & Society* 27:2&3, pp. 190-192.
- Bowker, G. and Latour, B. (1987) 'A Booming Discipline Short of Discipline: (social) studies of science in France', *Social Studies of Science* 17:4, pp. 715-748.
- Canguilhem, G. (1947) 'Notes sur la situation faite en France à la philosophie biologique', *Revue de Métaphysique et de Morale* 52, pp. 322-332.
- (1976) 'Nature dénaturé et Nature naturante', in *Savoir, faire, espérer: les limites de la raison*, Bruxelles: Facultés Universitaires Saint-Louis, pp. 71-87.
- (1977) *La formation du concept de reflexe aux XVIIe et XVIIIe siècles* [1955], Paris: Vrin.
- (1978) *On the Normal and the Pathological* [*Le normal et le pathologique*, 1943], trans. C.R. Fawcett, Dordrecht: Reidel.
- (1988) *Ideology and Rationality in the History of the Life Sciences* [*Idéologie et rationalité dans l'histoire des sciences de la vie*, 1988], trans. A. Goldhammer, Cambridge, MA: The MIT Press.
- (1994a) *A Vital Rationalist - selected writings from Georges Canguilhem*, trans. A. Goldhammer, F. Delaporte (ed.), , New York: Zone Books.

- (1994b) 'The Death of Man, or Exhaustion of the Cogito?' ['Mort de l'Homme ou épuisement du cogito?', 1967], trans. C. Porter, in G. Gutting (ed.) *The Cambridge Companion to Foucault*, Cambridge: Cambridge University Press, pp. 71-91.
- (1995) 'Report from Mr. Canguilhem on the Manuscript Filed by Mr. Michel Foucault', trans. A. Hobart, *Critical Inquiry* 21, pp. 277-281.
- (1996) *Vie et mort de Jean Cavaillès* [1976], Paris: Editions Allia.
- (1998) 'The Decline of the Idea of Progress ['La décadence de l'idée de progrès', 1987], trans. D. Macey, *Economy & Society* 27:2 & 3, pp. 313-329.
- (2000) *Idéologie et rationalité dans l'histoire des sciences de la vie* [1988], Paris: Vrin.
- (2002) *Etudes d'histoire et de philosophie des sciences* [1968], Paris: Vrin.
- (2003) *La connaissance de la vie* [1965], Paris: Vrin.
- (2006) *Le normal et le pathologique* [1943], Paris: Presses Universitaires de France.
- & Planet, C. (1939) *Traité de logique et de morale*, Marseille: F. Robert et Fils.
- et al. (eds.) (1984) *Anatomie d'un épistémologue: François Dagognet*, Paris: Vrin.
- Casey, E.S. (1984) 'Origin(s) in (of) Heidegger/Derrida', *The Journal of Philosophy* 10:81, pp. 601-610.
- Casini, P. (1992) 'Buffon et Newton', in J-C Beaune, S. Benoit et al. (eds.) *Buffon* 88, Paris: Vrin, pp. 299-308.
- Castells, M. (1996) *The Rise of the Network Society (The information age: economy, society, and culture vol. 1)*, Oxford: Blackwell.
- (1997) *The Power of Identity (The information age: economy, society, and culture vol. 2)*, Oxford: Blackwell.
- (1998) *End of Millenium (The information age: economy, society, and culture vol. 3)*, Oxford: Blackwell.
- Caygill, H. (1995) *A Kant Dictionary*, Oxford: Blackwell.
- Chernyak, L. and Tauber, A.I. (1991) 'The Dialectical Self: immunology's contribution', in A.I. Tauber (ed.) *Organism and the Origins of Self*, Dordrecht: Kluwer Academic Publishers, pp. 109-156.
- Christofferson, M.S. (2004) *French Intellectuals Against the Left - the antitotalitarian moment of the 1970s*, New York: Berghahn Books.
- Cobley, P. (ed.) (2001) *The Routledge Companion to Semiotics and Linguistics*, London: Routledge.

- Combes, M. (1999) *Simondon individu et collectivité - pour une philosophie du transindividuel*, Paris: Presses Universitaires de France.
- Dagognet, F. (ed.) (1965), *Gaston Bachelard - sa vie, son œuvre (avec un exposé de sa philosophie)*, Paris: Presses Universitaires de France.
- (1984) *La raison et les remèdes* [1964], Paris: Presses Universitaires de France.
- (1985) 'Une œuvre en trois temps', *Revue de métaphysique et de morale* 90:1, pp. 29-38.
- (1988) *La maîtrise du vivant*, Paris: Hachette.
- (1997) *Georges Canguilhem: philosophe de la vie*, Paris: Synthélabo.
- Darwin, C. (1998) *On the Origin of Species by Natural Selection or the Preservation of Favoured Races in the Struggle for Life* [1859], Hertfordshire: Wordsworth.
- Davidson, A.I. (ed.) (1997) *Foucault and his Interlocutors*, Chicago: University of Chicago Press.
- Debru, C. (1993) 'Georges Canguilhem et la normativité du pathologique: dimensions épistémologiques et éthiques', in E. Balibar, M. Cardot, F. Duroux et al. (eds.) *Georges Canguilhem - philosophe, historien des sciences*, Paris: Albin Michel, pp. 110-120.
- Deleuze, G. (1983) *Nietzsche and Philosophy* [*Nietzsche et la philosophie*, 1962], trans. H. Tomlinson, London: Athlone Press.
- (1988) *Bergsonism* [*Le Bergsonisme*, 1966], trans. H. Tomlinson & B. Habberjam, New York: Zone Books.
- & Guattari, F. (1994), *What is philosophy ?* [Qu'est-ce que la philosophie, 1991], trans. H. Tomlinson & G. Burchell, New York : Columbia University Press.
- (1997) *Le Pli - Leibniz et le baroque* [1988], Paris: Minuit.
- (1999) *Foucault* [*Foucault*, 1986], trans. S. Hand, London: Continuum.
- & Guattari, F. (1999), *A Thousand Plateaus - capitalism & schizophrenia* [*Mille plateaux - capitalisme et schizophrénie vol. 2*, 1980], trans. B. Massumi, London: The Athlone Press.
- (2001) *Pure Immanence - essays on A life*, trans. A. Boyman, New York: Zone Books.
- (2004) *Foucault* [1986], Paris: Minuit.
- Derrida, J. (1997) *Of Grammatology* [*De la grammatologie*, 1967], trans. G. Chakravorty Spivak, Baltimore: The Johns Hopkins University Press.

- Duroux, F. (1993) 'L'Imaginaire biologique du politique', in E. Balibar, M. Cardot, F. Duroux et al. (eds.) *Georges Canguilhem - philosophe, historien des sciences*, Paris: Albin Michel, pp. 49-57.
- Eisenberg, R.S. (2002) 'How can You Patent Genes?', *The American Journal of Bioethics* 2:3, pp. 3-11.
- Emerton, N. (1984) *The Scientific Reinterpretation of Form*, Ithaca: Cornell University Press.
- Emmeche, C.S. (1997) 'Explaining Emergence: towards an ontology of levels', *Journal for General Philosophy of Science* 28, pp. 83-119.
- Ernst, W. (ed.) (2006) *Histories of the Normal and the Abnormal: social and cultural histories of norms and normativity*, London: Routledge.
- Ewald, F. (1990) 'Norms, Discipline, and the Law', *Representations* 30, pp. 138-161.
- Falk, R. (2000) The Gene - a concept in tension, in P.J. Beurton, R. Falk and H.-J. Rheinberger (eds.) *The Concept of the Gene in Development and Evolution: historical and epistemological perspectives*, Cambridge: Cambridge University Press, pp. 317-348.
- Feldhoff, J. (1980) 'Milieu', in *Historisches Wörterbuch der Philosophie*, Basel: Schwabe, pp. 1393-1395.
- Ferrières, G. (1982) *Jean Cavaillès: un philosophe dans la guerre 1903-1944*, Paris: Seuil.
- Fichant, M. (1993) 'Georges Canguilhem et l'idée de la philosophie', in E. Balibar, M. Cardot, F. Duroux et al. (eds.) *Georges Canguilhem - philosophe, historien des sciences*, Paris: Albin Michel, pp. 37-48.
- Fleck, L. (1979) *Genesis and Development of a Scientific Fact* [Entstehung und Entwicklung einer wissenschaftlichen Tatsache: Einführung in die Lehre vom Denkstil und Denkkollektiv, 1935], trans. F. Bradley & T.J. Trenn, Chicago: University of Chicago Press.
- Flynn, T. (1994), 'Foucault's mapping of history', in G. Gutting (ed.) *The Cambridge Companion to Foucault*, Cambridge: Cambridge University Press, pp. 28-46.
- Foucault, M. (1978) Introduction, in *On the normal and the pathological*, G. Canguilhem, trans. C.R. Fawcett, Dordrecht: Reidel, pp. ix-xx.
- (1984a) 'What is Enlightenment?', in P. Rabinow (ed.) *The Foucault Reader - an introduction to Foucault's thought*, London: Penguin, pp. 32-50.
- (1984b) *Histoire de la sexualité 2 – L'usage des plaisirs*, Paris : Gallimard.

- (1985) 'La vie: l'expérience et la science', *Revue de métaphysique et de morale* 90:1, pp. 3-14.
 - (1986) *La pensée du dehors* [1966], Paris: Fata Morgana.
 - (1989) *The Birth of the Clinic: an archaeology of medical perception* [*Naissance de la Clinique*, 1963], trans. A.M. Sheridan, London: Routledge.
 - (1990) *The care of the self - The history of sexuality: 3*, [*Le souci de soi*, 1984], trans. R. Hurley, London: Penguin.
 - (1992) *The Use of Pleasure - The History of Sexuality: 2*, [*L'Usage des plaisirs*, 1984], trans. R. Hurley, London: Penguin.
 - (1995) *Discipline and Punish: the birth of the prison* [*Surveiller et punir*, 1975], trans. A.M. Sheridan, New York: Vintage Books.
 - (1997) 'Il faut défendre la société' - *cours au Collège de France (1975-1976)*, F. Ewald, A. Fontana, M. Bertani et al. (eds.), Paris: Gallimard/Seuil.
 - (1998) *The will to knowledge - The History of Sexuality: 1* [*La volonté de savoir*, 1976], trans. R. Hurley, London: Penguin.
 - (2001) 'Philosophie et vérité' (entretien avec A. Badiou, G. Canguilhem, D. Dreyfus, J. Hyppolite, P. Ricoeur), in *Dits et écrits I - 1954-1988* [1994], D. Defert, F. Ewald & J. Lagrange (eds.), Paris : Gallimard, pp. 476-492.
 - (2003) *Abnormal - Lectures at the Collège de France 1974-1975* [*Les anormaux - cours au Collège de France 1974-1975*, 1999], trans. G. Burchell, V. Marchetti & A. Salomoni (eds.), New York: Picador.
 - (2004) *Les mots et les choses - Une archéologie des sciences humaines* [1966], Paris: Gallimard.
 - (2006) *The Order of Things: An archaeology of the human sciences* [*Les mots et les choses - une archéologie des sciences humaines*, 1966], London: Routledge.
- Fox Keller, E. (1995) *Refiguring Life: changing metaphors in twentieth-century biology*, New York: Columbia University Press.
- (2000a) 'Models of and Models for: theory and practice in contemporary biology', *Philosophy of Science* 67, pp. S72-S86.
 - (2000b) 'Decoding the Genetic Program - or, some circular logic in the logic of circularity', in P.J. Beurton, R. Falk & H.-J. Rheinberger (eds.) *The Concept of the Gene in Development and Evolution: historical and epistemological perspectives*, Cambridge: Cambridge University Press pp. 159-177.

- (2000c) *The Century of the Gene*, Cambridge, MA: Harvard University Press.
- (2002) *Making Sense of Life - explaining biological development with models, metaphors, and machines*, Cambridge, MA: Harvard University Press.
- Franklin, S. (2003) 'Ethical Biocapital - new strategies of cell culture, in S. Franklin & M. Lock (eds.) *Remaking Life & Death - toward an anthropology of the biosciences*, Santa Fe/Oxford: School of American Research Press/James Currey, pp. 97-127.
- & Lock, M. (2003), 'Animation and Cessation - The Remaking of Life and Death', in S. Franklin & M. Lock (eds.) *Remaking Life & Death - toward an anthropology of the biosciences*, Santa Fe/Oxford: School of American Research Press/James Currey, pp. 3-22.
- Galison, P. (1994) 'The Ontology of the Enemy: Norbert Wiener and the cybernetic vision, *Critical Inquiry* 21:1 pp. 228-266.
- Gasché, R. (2007) *The Honor of Thinking: critique, theory, philosophy*, Stanford: Stanford University Press.
- Gayon, J. (1998) 'The Concept of Individuality in Canguilhem's Philosophy of Biology, *Journal of the History of Biology* 31, pp. 305-325.
- (2005) 'Bergson's Spiritualist Metaphysics and the Sciences', in G. Gutting (ed.) *Continental Philosophy of Science*, Oxford: Blackwell, pp. 43-58.
- Genova, A.C. (1974) 'Kant's Epigenesis of Pure Reason', *Kant-Studien* 65:3, pp. 259-273.
- Ginsborg, H. (1997) 'Kant on Aesthetic and Biological Purposiveness', in A. Reath, B. Herman & C.M. Korsgaard (eds.) *Reclaiming the History of Ethics - essays for John Rawls*, Cambridge: Cambridge University Press, pp. 329-360.
- (2001) 'Kant on Understanding Organisms as Natural Purposes', in E. Watkins (ed.) *Kant and the Sciences*, Oxford: Oxford University Press, pp. 231-258.
- Goldstein, K. (1963) *Der Aufbau des Organismus – Einführung in die Biologie unter besonderer Berücksichtigung der Erfahrungen am kranken Menschen* [1934], The Hague: Martinus Nijhoff.
- (1995) *The Organism: a holistic approach to biology derived from pathological data in man* [*Der Aufbau des Organismus - Einführung in die Biologie unter besonderer Berücksichtigung der Erfahrungen am kranken Menschen*, 1934], New York: Zone Books.
- Greene, M. & Depew, D. (2004) *The Philosophy of Biology - an episodic history*, Cambridge: Cambridge University Press.

- Greco, M. (2005) 'On the Vitality of Vitalism', *Theory, Culture & Society* 22:1, pp. 15-27.
- Griffiths, P. (2001) 'Genetic Information: a metaphor in search of a theory', *Philosophy of Science* 68, pp. 394-412.
- Gros, F. (1993) 'Hommage à Canguilhem', in E. Balibar, M. Cardot, F. Duroux et al. (eds.) *Georges Canguilhem – philosophe, historien des sciences*, Paris: Albin Michel, pp. 104-109.
- Gutting, G. (1989) *Michel Foucault's Archaeology of Scientific Reason*, Cambridge: Cambridge University Press.
- (1994) 'Foucault and the history of madness', in G. Gutting (ed.) *The Cambridge Companion to Foucault*, Cambridge: Cambridge University Press, pp. 47-70.
- (2005a) *Foucault: A Very Short Introduction*, Oxford: Oxford University Press.
- (2005b) 'Introduction: What is Continental Philosophy of Science?', in G. Gutting (ed.) *Continental Philosophy of Science*, London: Blackwell, pp. 1-16.
- Hacking, I. (1982) 'Biopower and the Avalanche of Printed Numbers', *Humanities in Society* 5:3&4, pp. 279-95.
- (1983) *Representing and Intervening: introductory topics in the philosophy of natural science*, Cambridge: Cambridge University Press.
- (1998) 'Canguilhem Amid the Cyborgs', *Economy and Society* 27:2&3, pp. 202-216.
- (2002) *Historical Ontology*, Cambridge, MA: Harvard University Press.
- (2004) 'Between Michel Foucault and Erving Goffman: between discourse in the abstract and face-to-face interaction', *Economy & Society* 33:3, pp. 277-302.
- Hage, J. (1978) 'Toward a Synthesis of the Dialectic between Historical-Specific and Sociological-General Models of the Environment', in L. Karpik (ed.) *Organization and Environment: theory, issues and reality*, London: Sage, pp. 103-145.
- Halpern, B. (1967) 'Allocution', in R. Heim, B. Halpern, Y. Bourges (eds.) *Les concepts de Claude Bernard sur le milieu intérieur*, Paris: Masson & Cie, pp. 4-6.
- Haraway, D.J. (1976) *Crystals, Fabrics and Fields*, New Haven: Yale University Press.
- (1991) *Simians, Cyborgs and Women - the reinvention of nature*, London: Free Association Books.
- Hayles, N.K. (1993) 'The Materiality of Informatics', *Configurations* 1:1, pp. 147-170.
- (1999) *How we Became Posthuman - Virtual Bodies in Cybernetics, Literature and Informatics*, Chicago: University of Chicago Press.

- (2005) *My Mother was a Computer - digital subjects and literary texts*, Chicago: University of Chicago Press.
- Heidegger, M. (1977) *The Question Concerning Technology and Other Essays*, trans. W. Lovitt, New York: Harper & Row Publishers.
- (1997) *Kant and the Problem of Metaphysics* [Kant und das problem der metaphysik, 1929], trans. R. Taft, Indianapolis: Indiana University Press.
- Helmreich, S. (1998) *Silicon Second Nature - culturing artificial life in a digital world*, Berkeley, CA: University of California Press.
- (2003) 'Trees and seas of information: alien kinship and the biopolitics of gene transfer in marine biology and biotechnology', *American Ethnologist* 30:3, pp. 340-358.
- Henry, C.M. (2003) 'Systems Biology', *Chemical and Engineering News* 81:20, pp. 45-55.
- Hertogh, C.M.P.M. (1986) *Bachelard en Canguilhem: epistemologische discontinuïteit en het medisch normbegrip*, Amsterdam: Vrije Universiteit.
- Hesse, M. (1966) *Models and Analogies in Science*, Notre Dame: Notre Dame University Press.
- Huneman, P. (2006) 'Naturalising Purpose: from comparative anatomy to the "adventure of reason"', *Studies in History and Philosophy of Science; Part C: Studies in History and Philosophy of Biological and Biomedical Sciences* 37:4, pp. 649-674.
- (ed.) (2007a) *Understanding Purpose - Kant and the Philosophy of Biology*, Rochester, NY: University of Rochester Press.
- (2007b) 'Introduction - Kant and Biology? A Quick Survey', in P. Huneman (ed.) *Understanding Purpose - Kant and the Philosophy of Biology*, Rochester, NY: University of Rochester Press, pp. 1-36.
- Hunter, I. (2007) 'The History of Philosophy and the Persona of the Philosopher', *Modern Intellectual History* 4:3, pp. 571-600.
- Iliffe, R. (2007) *Newton: a very short introduction*, Oxford: Oxford University Press.
- Ingensiep, H. (1994) 'Die biologischen Analogien und die erkenntnistheoretischen Alternativen in Kants *Kritik der reinen Vernunft* B27', *Kant Studien* 85, pp. 381-393.
- Jackson, M.W. (1999) 'The State and Nature of Unity and Freedom: German Romantic biology and ethics, in J. Maienschein & M. Ruse (eds.) *Biology and the Foundations of Ethics*, Cambridge: Cambridge University Press, pp. 98-112.

- Jacob, F. (1976) *The logic of life: a history of heredity* [*La logique du vivant - une histoire de l'hérédité*, 1976], trans. B.E. Spillmann, New York : Vintage.
- Jasanoff, S. (2004) 'Ordering Knowledge, Ordering Society', in S. Jasanoff (ed.) *States of Knowledge: the co-production of science and social order*, London: Routledge, pp. 13-45.
- Jasanoff, S. (2005) *Designs on Nature: science and democracy in Europe and the United States*, Princeton, NJ: Princeton University Press.
- Judt, T. (1992) *Past Imperfect - French Intellectuals, 1944-1956*, Berkeley: University of California Press.
- Kant, I. (1963) 'What is Enlightenment?' ['Beantwortung der Frage: Was ist Aufklärung?'], 1784], trans. L.W. Beck, in L.W. Beck (ed) *On History - Immanuel Kant*, Indianapolis: The Bobbs-Merrill Company, pp. 3-10.
- (1987) *Critique of Judgment* [*Critik der Urteilskraft*, 1790], trans. W.S. Pluhar, Indianapolis: Hackett.
- (2003) *Critique of Pure Reason* [*Critik der reinen vernunft*, 1781], trans. J.M.D. Meiklejohn, New York: Dover.
- (2004) *Groundwork of the Metaphysics of Morals* [*Grundlegung zur Metaphysik der Sitten*, 1785], trans. M. Gregor, Cambridge: Cambridge University Press.
- Kay, L.E. (2000) *Who Wrote the Book of Life? - a history of the genetic code*, Stanford: Stanford University Press.
- Kevin Hill, R. (2003) *Nietzsche's Critiques - the Kantian foundations of his thought*, Oxford: Clarendon Press.
- Kitcher, P. (1982) 'Genes', *The British Journal for the Philosophy of Science* 33:4, pp. 337-359.
- Kjaer, P. (2006) 'Systems in Context - on the outcome of the Habermas-Luhmann debate', *Ancilla Iuris* 66, pp. 66-77.
- Knorr Cetina, K. (1981) *The Manufacture of Knowledge*, Oxford: Pergamon.
- (1999), *Epistemic Cultures - how the sciences make knowledge*, Cambridge: Harvard University Press.
- Landecker, H. (2003) 'On Beginning and Ending with Apoptosis - cell death and biomedecine', in S. Franklin & M. Lock (eds.) *Remaking Life & Death - toward an anthropology of the biosciences*, Santa Fe/Oxford: School of American Research Press/James Currey, pp. 23-59.

- Lash, S. (2002) *Critique of Information*, London: Sage.
- (2006) 'Life (vitalism)', *Theory, Culture & Society* 23:2&3, pp. 323-329.
- Latour, B. (1993) *We Have Never Been Modern*, New York: Harvester Wheatsheaf.
- (1999a) *Pandora's Hope – essays on the reality of science studies*, Cambridge, MA: Harvard University Press.
- (2002) *Science in Action - how to follow scientists and engineers through society* [1987], Cambridge, MA: Harvard University Press.
- (2007) 'Can we get our materialism back, please?', *Isis* 98, pp. 138-142.
- & Woolgar S. (1986), *Laboratory Life - the social construction of scientific facts* [1979], Princeton, NJ: Princeton University Press.
- LeBlanc, G.L. (1998) *Canguilhem et les normes*, Paris: Presses Universitaires de France.
- (2002a) *Anthropologie et biologie chez Georges Canguilhem*, Paris: Presses Universitaires de France.
- (2002b) 'La vie selon ses points de vue', in G.L. LeBlanc (ed.) *Lectures de Georges Canguilhem - le normal et le pathologique*, Lyon: ENS, pp. 49-60.
- Lecourt, D. (1974) *Bachelard ou le jour et la nuit (un essai du materialisme dialectique)*, Paris: Bernard Grasset.
- (1975) *Marxism and Epistemology - Bachelard, Canguilhem and Foucault*, London: NLB.
- (1998) 'Georges Canguilhem on the Question of the Individual', *Economy and Society* 27:2&3, pp. 217-224.
- Lenoir, T. (1980) 'Kant, Blumenbach, and Vital Materialism in German Biology', *Isis* 71:1, pp. 77-108.
- (1982) *The Strategy of Life - teleology and mechanics in nineteenth century German biology*, Dordrecht: Reidel.
- (1988) 'Practice, Reason, Context: the dialogue between theory and experiment', *Science in Context* 2, pp. 3-22.
- Levy, B.-H. (1995) *Adventures on the Freedom Road - The French Intellectuals in the 20th Century*, London: The Harvill Press.
- Lewontin, R. (1991) 'Foreword', in A.I. Tauber (ed.) *Organism and the Origins of Self*, Dordrecht: Kluwer, pp. xiii-xix.
- (2000) *The Triple Helix: gene, organism, environment*, Cambridge: Harvard University Press.

- Lloyd, G. (1996) 'Reason, Science and the Domination of Matter, in E. Fox Keller & H.E. Longino (eds.), *Feminism and Science*, Oxford: Oxford University Press, pp. 41-53.
- Luhmann, N. (1996) *Social Systems* [Soziale Systeme: Grundriß einer allgemeinen Theorie, 1984], trans. J. Bednarz, Jr., Stanford: Stanford University Press.
- (1998) *Observations on Modernity* [Beobachtungen der moderne, 1992], transl. W. Wohbrey, Stanford: Stanford University Press.
- Lyotard, J-F. (1979) *La condition postmoderne: rapport sur le savoir*, Paris: Minuit.
- Macey, D. (1998) 'The Honour of Georges Canguilhem', *Economy & Society* 27:2&3, pp. 171-181.
- Macherey, P. (1993) 'De Canguilhem à Canguilhem en passant par Foucault', in E. Balibar, M.Cardot, F. Duroux, et al. (eds) *Georges Canguilhem - philosophe et historien des sciences*, Paris: Albin Michel, pp. 286-294.
- (1998) 'Normes vitales et normes sociales dans l'essai sur quelques problèmes concernant le normal et le pathologique', in F. Bing, J-F. Braunstein & E. Roudinesco (eds.) *Actualité de Georges Canguilhem - Le normal et le pathologique*, Paris: Synthélabo, pp. 71-84.
- Malik, S. (2005) 'Information and Knowledge', *Theory, Culture & Society* 22:1, pp. 29-49.
- Manchester, P. (2003) 'Kant's Conception of Architectonic in its Historical Context', *Journal of the History of Philosophy* 41:2, pp. 187-207.
- Mathiot, J. (1993) 'Genetique et connaissance de la vie', in E.Balibar, M. Cardot, F. Duroux et al. (eds.) *Georges Canguilhem - philosophe et historien des sciences*, Paris: Albin Michel, pp. 194-207.
- Matthews David, A. (2006) 'Made to Measure? Tailoring and the "normal" body in nineteenth-century France', in W. Ernst (ed.) *Histories of the Normal and the Abnormal: social and cultural histories of norms and normativity*, London: Routledge, pp. 142-164.
- Maturana, H.R. & Varela, F.J. (1980) *Autopoiesis and Cognition: the realization of the living* [De Máquinas y Seres Vivos, 1972], Dordrecht: Reidel.
- (1992) *The Tree of Knowledge - the biological roots of human understanding*, [El arbol del conocimiento, 1987], trans. R. Paolucci, Boston: Shambhala.
- McGoey, L. (2007) 'On the Will to Ignorance in Bureaucracy', *Economy & Society* 36:2, pp. 212-235.

- McKenzie, A. (2003) 'Bringing Sequences to Life: how bioinformatics corporealizes sequence data', *New Genetics and Society* 22:3, pp. 315-332.
- (2006) *Transductions - bodies and machines at speed*, London: Continuum.
- McLaughlin, P. (2007) 'Kant on Heredity and Adaptation', in S. Müller-Wille & H-J. Rheinberger (eds.) *Heredity Produced: at the crossroads of biology, politics, and culture 1500-1870*, Cambridge, MA: The MIT Press, pp. 278-291.
- Megill, A. (1987) 'The Reception of Foucault by Historians', *Journal of the History of Ideas* 48:1, pp. 117-141.
- Moss, L. (2003) *What Genes Can't Do*, Cambridge, MA: The MIT Press.
- Müller-Sievers, H. (1993) *Epigenesis – - Naturphilosophie im Sprachdenken Wilhelm von Humboldts*, Paderborn: Ferdinand Schöningh.
- (1997) *Self-Generation - biology, philosophy, and literature around 1800*, Stanford: Stanford University Press.
- Müller-Wille, S. & Rheinberger, H-J. (2007) 'Heredity - The Formation of an Epistemic Space', in S. Müller-Wille & H-J. Rheinberger, *Heredity produced: at the crossroads of biology, politics, and culture 1500-1870*, Cambridge, MA: The MIT Press, pp. 3-34.
- Nietzsche, F. (1968) *The Will to Power*, trans. W. Kaufmann & R.J. Hollingdale, W. Kaufman (ed.), London: Weidenfeld and Nicolson.
- (1971) *Also sprach Zarathustra - Ein Buch für Alle und Keinen* [1883-1885], New York: Frederick Ungar.
- (1983) *Nietzsche: Untimely Meditations*, trans. R.J. Hollingdale, D. Breazeale (ed.), Cambridge: Cambridge University Press.
- (2005) *The Anti-Christ, Ecce Homo, Twilight of the Idols - and other writings*, trans. J. Norman, A. Ridley & J. Norman (eds.), Cambridge: Cambridge University Press.
- Norris, C. (1994) "'What is enlightenment?': Kant according to Foucault, in G. Gutting (ed.) *The Cambridge Companion to Foucault*, Cambridge: Cambridge University Press, pp. 159-196.
- Novas, C. & Rose, N. (2000) 'Genetic Risk and the Birth of the Somatic Individual', *Economy and Society* 29:4, pp. 485-513.
- Olma, S. and Koukouvelis, K. (2007) 'Introduction - Life's (Re-)Emergences', *Theory, Culture & Society* 24:6, pp. 1-17.
- Osborne, T. (2003) 'What is a problem?', *History of the Human Sciences* 16:4, pp. 1-17.

- Oyama, S. (1985) *The Ontogeny of Information - developmental systems and evolution*, Durham, NC: Duke University Press.
- (2000) *Evolution's Eye. A systems view of the biology-culture divide*, Durham, NC: Duke University Press.
- Parnes, O.S. (2007) 'On the Shoulders of Generations: the new epistemology of heredity in the nineteenth century, in S. Müller-Wille & H-J. Rheinberger (eds.), *Heredity Produced: at the crossroads of biology, politics, and culture 1500-1870*, Cambridge, MA: The MIT Press, pp. 315-347.
- Parry, B. (2004a) *Trading the Genome - investigating the commodification of bio-information*, New York: Columbia University Press.
- (2004b) 'Bodily Transactions. Regulating a new space of flows in bio-information', in K. Verdery & C. Humphrey (eds.) *Property in Question: value transformation in the global economy*, New York: Berg.
- & Gere, C. (2006) 'Contested Bodies: property models and the commodification of human biological artefacts', *Science as Culture* 15:2, pp. 139-158.
- Pearson, K.A. (1999) *Germinal Life - the difference and repetition of Deleuze*, London: Routledge.
- Petit, A. (1987) 'Claude Bernard and the History of Science', *Isis* 78:2, pp. 201-219.
- Pequignot, H. (1985) 'Georges Canguilhem et la medecine', *Revue de métaphysique et de morale* 90 :1, pp. 39-51.
- Piquemal, J. (1985) 'G. Canguilhem, professeur de terminale (1937-1938): un essai de temoignage', *Revue de métaphysique et de morale* 90:1, pp. 63-83.
- Pottage, A. (1998a) 'The Inscription of Life in Law: genes, patents, and bio-politics', *Modern Law Review* 61:5, pp. 740-765.
- (1998b) 'Power as an Art of Contingency: Luhmann, Deleuze, Foucault', *Economy & Society* 27:1 , pp. 1-27.
- (2001) 'Persons and Things: an ethnographic analogy', *Economy and Society* 30:1, pp. 112-138.
- (2002) "'Unitas Personae": on legal and biological self-narration, *Law and Literature* 14:2, pp. 275-308.
- (2006) 'Too Much Ownership: bio-prospecting in the age of synthetic biology, *BioSocieties* 1, pp. 137-158.
- Prenant, M. (1935) *Biologie et Marxisme*, Paris: Editions sociales internationales.

- Prochiantz, A. (1993) 'Le materialisme de Georges Canguilhem', in E. Balibar, M. Cardot, F. Duroux et al. (eds.), *Georges Canguilhem - philosophe, historien des sciences*, Paris: Albin Michel, pp. 271-278.
- Rabinow, P. (1996) *Essays on the Anthropology of Reason*, Princeton: Princeton University Press.
- (1998) 'French Enlightenment: truth and life', *Economy and Society* 27:2&3, pp. 193-201.
- (1999) *French DNA: Trouble in Purgatory*, Princeton: Princeton University Press.
- & Caduff, C. (2006) 'Life - after Canguilhem', *Theory, Culture & Society* 23:2&3, pp. 329-331.
- & Rose, N. (2006) 'Biopower Today', *BioSocieties* 1 (2006), pp. 195-217.
- Rheinberger, H-J. (1995) 'Beyond Nature and Culture: a note on medicine in the age of molecular biology', *Science in Context* 8:1, pp. 249-263.
- (1997a) *Toward a History of Epistemic Things - synthesizing proteins in the test tube*, Stanford: Stanford University Press.
- (1997b) 'Experimental Complexity in Biology: some epistemological and historical remarks', *Philosophy of Science* 64, pp. S245-S254.
- (2000) 'Gene Concepts - fragments from the perspective of molecular biology', in P.J. Beurton, R. Falk & H-J. Rheinberger (eds.) *The Concept of the Gene in Development and Evolution: historical and epistemological perspectives*, Cambridge: Cambridge University Press, pp. 219-239.
- (2005a) 'Gaston Bachelard and the notion of "phenomenotechnique"', *Perspectives on Science* 13:3, pp. 313-328.
- (2005b) 'Reassessing the Historical Epistemology of Georges Canguilhem', in G. Gutting (ed.) *Continental Philosophy of Science*, Cambridge, MA: Blackwell, pp. 187-197.
- & Gaudillière, J-P. (2004) (eds.) *Classical Genetic Research and Its Legacy - the mapping cultures of twentieth-century genetics*, London: Routledge.
- Richards, R.J. (2000) 'Kant and Blumenbach on the Bildungstrieb: A Historical Misunderstanding', *Studies in History and Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences* 31:1, pp. 11-32.
- Rose, G. (1984) *Dialectic of Nihilism, Post-Structuralism and Law*, Oxford: Basil Blackwell.

- Rose, N. (1998) 'Life, Reason and History: reading Georges Canguilhem today', *Economy and Society* 27:2&3, pp. 154-170.
- (2001) 'The Politics of Life Itself', *Theory, Culture & Society* 18:6, pp. 1-30.
- (2007), *The Politics of Life Itself - biomedicine, power, and subjectivity in the twenty-first Century*, Princeton: Princeton University Press.
- & Novas, C. (2004) 'Biological Citizenship', in A. Ong & S. Collier (eds.) *Global Assemblages: technology, politics, and ethics as anthropological problems*, Cambridge, MA: Blackwell, pp. 439-463.
- Rouse, J. (1994) 'Power/Knowledge', in G. Gutting (ed.) *The Cambridge Companion to Foucault*, Cambridge: Cambridge University Press, pp. 92-114.
- Schrift, A.D. (1995) *Nietzsche's French Legacy - a genealogy of poststructuralism*, New York: Routledge.
- Schulte, G.,(1993) *Der blinde Fleck in Luhmanns Systemtheorie*, Frankfurt: Campus Verlag.
- Schütz, A. (1997), 'The Twilight of the Global Polis: on losing paradigms, environing systems and observing world society, in G. Teubner (ed.) *Global Law Without a State*, Dartmouth: Aldershot, pp. 257-293.
- Simondon, G. (1958) *Du mode d'existence des objets techniques*, Paris: Méot.
- (1964) *L'individu et sa genèse physico-biologique (l'individuation à la lumière des notions de forme et d'information)*, Paris: Presses Universitaires de France.
- Sinding, C. (1999) 'Claude Bernard and Louis Pasteur - contrasting images through public commemorations', *Osiris* 14, pp. 61-85.
- Sirinelli, J-F. (1994) *Génération intellectuelle: khâgneux et normaliens dans l'entre-deux-guerres* [1988], Paris: Fayard.
- (1995) *Deux intellectuels dans le siècle, Sartre et Aron*, Paris: Payard.
- Sloan, P.R. (2002) 'Preforming the Categories: eighteenth-century generation theory and the biological roots of Kant's a priori', *Journal of the History of Philosophy* 40:2, pp. 229-253.
- (2006) 'Kant on the History of Nature: the ambiguous heritage of the critical philosophy for natural history', *Studies in History and Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences* 37:4, pp. 627-648.

- Steigerwald, J. (2002) 'Instruments of Judgment: inscribing organic processes in late eighteenth-century Germany', *Studies in History and Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences* 33, pp. 79-131.
- Stiegler, B. (1998) 'Temps et individuation technique, psychique et collective dans l'œuvre de Simondon', *Intellectica* 1-2 :26-27, pp. 241-256.
- (2001) 'De Canguilhem à Nietzsche: la normativité du vivant', in G.L. LeBlanc (ed.) *Lectures de Canguilhem - le normal et le pathologique*, Lyon: ENS, pp. 85-101.
- Strathern, M. (1996) 'Cutting the Network', *Journal of the Royal Anthropological Institute* 2, pp. 517-535.
- Sunder Rajan, K. (2006) *Biocapital: the constitution of postgenomic life*, Durham, NC: Duke University Press.
- Tauber, A.I. (1991) 'Introduction: speculations concerning the origins of the self, in A.I. Tauber (ed.) *Organism and the Origins of Self*, Dordrecht: Kluwer, pp. 1-39.
- (1994) *The Immune Self: theory or metaphor?*, Cambridge: Cambridge University Press.
- Thacker, E. (2004) *Biomedica. Electronic Mediations*, Minneapolis: University of Minnesota Press.
- (2005) *The Global Genome - biotechnology, politics, and culture*, Cambridge, MA: The MIT Press.
- Thrift, N. (2006) 'Space', *Theory, Culture & Society* 23:2&3, pp. 139-146.
- Tiles, M. (2005) 'Technology, Science, and Inexact Knowledge: Bachelard's non-Cartesian epistemology', in G. Gutting (ed.) *Continental Philosophy of Science*, Cambridge, MA: Blackwell, pp. 157-175.
- Varela, F.J. (1991) 'Organism: a meshwork of selfless selves', in A.I. Tauber (ed.) *Organism and the Origins of Self*, Dordrecht: Kluwer, pp 79-107.
- Von Uexküll, J. (1936), *Niegeschaute Welten - Die Umwelten meiner Freunde, ein Erinnerungsbuch von J. von Uexküll*, Berlin: S. Fischer Verlag.
- (1957) 'A Stroll Through the Worlds of Animals and Men - a picture book of invisible worlds' ['Streifzüge durch die Umwelten von Tieren und Menschen - Ein Bilderbuch unsichtbarer Welten', 1934], in C.H. Schiller (ed.) *Instinctive Behavior - the development of a modern concept*, London: Methuen & Co, pp. 5-80.

- Von Uexküll, J. (1982) 'The Theory of Meaning', *Semiotica* 42:1, pp. 25-82.
- Von Uexküll, T. (1982) 'Introduction: Meaning and Science in Jakob von Uexküll's Concept of Biology', *Semiotica* 42:1, pp. 1-24.
- Waddington, C.H. (1977) *Tools for Thought*, St. Albans: Paladin.
- Waldby, C. (2002) 'Stem cells, tissue cultures and the production of biovalue', *Health: An Interdisciplinary Journal for the Social Study of Health, Illness and Medicine* 6:3, pp. 305-323.
- Walsh, D.M. (2006), 'Organisms as Natural Purposes: the contemporary evolutionary perspective', *Studies in History and Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences* 37:4, pp. 771-791.
- Waters, K. (1994) 'Genes Made Molecular', *Philosophy of Science* 61, pp. 163-185.
- Westfall, R.S. (1971), *Force in Newton's Physics - the science of dynamics in the seventeenth century*, London/New York: MacDonald/American Elsevier.
- Winthrop-Young, initial (2003), 'On a Species of Origin: Luhmann's Darwin', *Configurations* 11, pp. 305-349.
- Wübnig, J. (1969) 'The Epigenesis of Pure Reason - a note on the *Critique of Pure Reason*, Bsec.27, *Kant-Studien* 60:2, pp. 147-152.
- Zammito, J.H. (1992) *The Genesis of Kant's Critique of Judgment*, Chicago: University of Chicago Press.
- (2003) 'This Inscrutable Principle of an Original Organization: epigenesis and "looseness of fit" in Kant's philosophy of science', *Studies in History and Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences* 34:1, pp. 73-109.
- (2006) 'Teleology Then and Now: the question of Kant's relevance for contemporary controversies over function in biology', *Studies in History and Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences* 37:4, pp. 748-770.
- (2007) 'Kant's Persistent Ambivalence towards Epigenesis', in P. Huneman (ed.) *Understanding Purpose - Kant and the philosophy of biology*, Rochester, NY: University of Rochester Press, pp. 51-74.
- (2008) 'Médecin-philosoph: persona for radical enlightenment', *Intellectual History Review* 18:3, pp. 427-440.

- Zižek, S. (2003) *Organs without Bodies: on Deleuze and consequences*, London: Routledge.
- Zöller, G. (1988), 'Kant on the Generation of Metaphysical Knowledge', in H. Oberer & G. Seel, (eds.) *Kant: analysen, probleme, kritik*, Würzburg: Konigshausen & Neumann, pp. 71-90.
- Zuckert, R. (2007), *Kant on Beauty and Biology - an interpretation of the Critique of Judgment*, Cambridge: Cambridge University Press.
- Zumbach, C. (1984), *The Transcendent Science - Kant's conception of biological methodology*, The Hague: Martinus Nijhoff.