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# Catching Colds with Canguilhem: Culturing Relations with Common Cold Viruses

Beth Greenhough 

*University of Oxford, UK*

This paper draws on the thought of the historian of science, Georges Canguilhem, to explore how the practice of making medical knowledge brings into question accepted understandings of (ill)health and contagious disease. Drawing out how the lively materialities of both humans and viruses shape human experience of viral infection, the analysis focuses on written and oral histories of the UK's Common Cold research Unit (CCU), associated scientific papers and correspondence between 1961 and 1965, and press cuttings and visitors' books from the CCU archives, in order to offer multiple readings of the relationship between humans and cold viruses at this site. These alternative post-natural histories challenge our preconceptions about the costs and benefits of living-with-viruses and the role of infection and associated symptoms in drawing lines between the normal and the pathological. The archives of the CCU offer new ways of encountering viruses and their histories, and evidence that that infection can be, as Canguilhem suggests, a "positive, innovative experience," while at the same time questioning the novelty of recent posthumanist accounts of human-virus relations.

**Key Words:** Canguilhem, Common Cold, posthumanism, virus, vitalism.

## INTRODUCTION: THE NORMAL, THE PATHOLOGICAL AND THE MICROBIAL

Writing first in 1940, and later in the mid-1960s, historian of science Georges Canguilhem argues that the definition of the pathological is found in the specificities of human experience. Disease cannot be defined objectively, as deviation from an established norm; rather it is chronological and involves a disruption of a course, a "feeling of life gone wrong" (1991, 137; see also Philo 2007). According to Canguilhem (drawing on Comte), health and disease are differences of degree, not kind. They are value judgements that need to be established qualitatively, not quantitatively (Canguilhem 1991, 131). Following this definition, what makes something like the Common Cold an illness is not the presence or absence of a viruses, but the extent to which the symptoms of that viral infection resolve into the patient's feeling that their life has been disrupted.

Viral infection sits uneasily within Canguilhem's continuum of the normal and the pathological<sup>1</sup>: "Strictly speaking, it takes a microbe to make an infection [and] it seems difficult to assert that the infectious state produced no real discontinuity in the history of the living being" (Canguilhem 1991, 85). Unlike other forms of illness, which can be attributed to changes within the organism itself, and its relationship to its environment (*milieu*<sup>2</sup>), viruses allow us to attribute symptoms (and usually unpleasant ones) to an outside agency. They are easy (at least in terms of attributing blame) targets. Viruses provided an ontological locus for the germ theory of disease, a cause of illness that could be identified, seen and tackled. Consequently, the therapeutic challenge is not bringing the patient back to their normal healthy state, but getting rid of the virus.

The war against microbes, which began with the germ theory of disease, becomes the precursor of what Wald (2008) describes as the "outbreak narrative." In *Contagious*, her account of the

cultural narratives that accompany communicative disease, she charts the emergence of a dominant social response to disease as this becomes woven into discourses of nationhood and concerns over national security and borders. Her account resonates with work in health geography exploring the stigmatisation of infected individuals (Brown and Watson 2010; Brown 2000) and communities (Craddock 2000) and the interpellation of discourses of biosecurity and national security (Braun 2007). It also highlights the role of particular scales of geographical imagination, ranging from the role of the outbreak narrative and ideas of contagion in shaping early social theory (Wald 2008); to the role of orientalism and biopolitics in defining which communities “in here” should be protected from an externalised disease carrying other “Over there” (Braun 2007); to the recognition of globalisation as a key driving force in processes of space-time compression which generate new urban ecologies and breeding grounds for communicable disease (Wallace 2009; Ali and Keil 2008) necessitating new forms of global (OneHealth) governance (Craddock and Hinchliffe 2015; Hinchliffe 2015). These discourses and geographical imaginations then inform the emergence of contemporary forms of microbiopolitics, which tend to emphasise microbial threats over microbial possibilities (Paxson 2008; Greenhough et al. 2018) and show a surprising lack of sensitivity to the cultural and social contexts within which disease plays out<sup>3</sup>.

Here I do not wish to deny the seriousness of these threats—COVID-19 and Anti-Microbial Resistance (AMR), for example, pose real and ongoing risks to global health—yet, as Lorimer (2017) notes, we seem now to be in the midst of a new “microbial moment.” Alongside dominant antibiotic dispositions there are, rising up, a wave of new more probiotic sentiments (Yong 2016) and experimental practices (Lorimer 2016), as well as renewed interest in more traditional human-microbe entanglements such as those found in the production of food stuffs (Paxson 2008). This perspective is shared by evolutionary biologist Margulis who emphasises the key role played by microbes in human evolution through the process of symbiogenesis (Hird 2009). Equally philosopher of science Haraway (2008, 26) finds in our immunological record the legacy of our past relations with viruses. Such developments moderate concerns over issues such as AMR, and almost instinctive biopolitical/thanatopolitical responses to viral threats, with an entreaty to pay attention to the complexities, specificities and particularities of human-microbial entanglements (Greenhough et al. 2018). Hence this paper seeks to nuance geographical imaginations dominated by a sense of an externalised viral threat “over there” to one constituted through an attention to the borderlands (Hinchliffe et al. 2013) where humans, animals and viruses, meet, mingle, live and co-evolve.

In this paper I wish to deepen our understanding of microbial geographies by paying attention to moments of human-viral co-habitation in the past, drawing on the archives of the UK’s Common Cold Research Unit (hereafter CCU), and the writings of vitalist<sup>4</sup> thinker and historian of science Canguilhem. I begin by offering some reflections on how Canguilhem’s approach involves a geographically-infused insistence on what I will term the “situatedness of infection” (paraphrasing Haraway’s (1988) situated knowledges), and an approach to health geography sensitive to “geographies of medicine” (Philo 2007, 82). This in turns brings this piece into dialogue with broader moves at the intersection of medical humanities and health geographies to push “against more standardized dis/un/placed or space-neutralized biomedical understandings of health, illness, and human well-being” (de Leeuw et al. 2018, 288). I also offer a short account of my approach to the CCU archive. I then turn to examine how within the CCU: (i) scientific practices create distinctive forms of human-virus ecology; (ii) the implications of this for researcher’s abilities to use scientific knowledge to tackle infectious disease; and (iii) the

implications of this for our understanding of, and certainty about, what constitutes normal and pathological viral entanglements. The discussion then seeks to draw out how Canguilhem's work can nuance contemporary posthumanist approaches to understanding infectious disease as part of a wider posthuman turn in health geography (Andrews 2019).

## TROUBLED TERRAINS AND THE SITUATEDNESS OF INFECTION

In contrast to the more deadly diseases which often form the focus of work in health and more-than-human geographies, the ubiquitous and endemic nature of many Common Cold viruses poses problems for our understanding of the Common Cold (or any endemic infection) as pathological. As van Loon (2005) has noted, the definition of a disease as endemic requires that it ceases to disrupt everyday life. In effect, the disease becomes normalized; we learn to live with it. This is essentially one of Canguilhem's key arguments; there is nothing abnormal, (or to use the biopolitical terminology nothing exceptional), about disease. To see evidence of such normalisation we need look no further than the host of Common Cold remedies on the market, which provide not cures for the Common Cold, but symptomatic treatments aimed at making it easier to live with.

To an extent Canguilhem acknowledges this problematic. In critiquing the work of experimental pathologist Bernard, and his endeavors to determine the pathological state quantitatively, Canguilhem suggests that "it is a good idea to bear in mind the *terrain* as Pasteur himself advised" (Canguilhem 1991, 85). *Terrain*, for Canguilhem, is closely related to embodiment and refers to an organism's resistance to pathogenic agents and predisposition to particular diseases. He offers us a relational understanding of society's relationship with Common Colds, one which suggests the experience of having a cold is shaped not only by the actions of the virus, but also by how humans (as both thinking and fleshy beings) respond to them. As Jackson and Henry (2017, 179; see also Philo 2007) argue, "health is not some a priori pure state of bodily integrity. Disease is not introduced into purity; rather, disease reduces one's tolerance to ongoing environmental and biological processes." Furthermore, through its attention to bodies-in-context, *terrain* also extends beyond the limits to the human body and considers that body's relationship with its environment or *milieu*. Canguilhem (1991; see also Elden 2019, 16; Philo 2007, 85), gives the example of a farmhand with a broken leg, and argues that the extent to which his condition is debilitating (pathological) depends not on the kind of injury, but on how that injury disrupts his everyday life, which in turn is a function of his existence on the farm. Canguilhem therefore shares with health geography an insistence on the role of embodiment (Moss and Dyck 2003) and landscape (Kearns and Gesler 1998) in the formation of experiences of health and disease.

More specifically, Canguilhem (1991, 88) insists that pathology (as knowledge of ill health) can only be established in the clinical context and in dialogue with the patient and their experience:

Pathology, whether anatomical or physiological, analyses in order to know more, but it can be known as pathology, that is, as the study of the mechanisms of disease, only insofar as it receives from clinical practice this notion of disease, whose origin must be sought in the experience men [sic] have in their relations with the whole of their environment.

By insisting on the centrality of the bodily, social and environmental context of disease, Canguilhem suggests that whether humans experience the Common Cold (or any other kind of

viral infection) as a disease—as a threat to be eradicated—depends on the context within which they encounter it and the ways in which their bodies and the virus respond to this encounter. As Hinchliffe et al. (2013, 537) argue,

Being healthy may not simply mean being free from pathogens, but a matter of immunocompetence; that is, the ability to live with a variety of other organisms that are always in circulation. [...] Disease, in this sense, becomes less about contamination and contagion, and more concerned with its systemic and endemic co-generation.

However, where Canguilhem emphasises the situatedness of the human patient, a more-than-human approach (Hinchliffe 2015; Greenhough 2012a) may equally wish to explore the situatedness of the microbe. For Paxson and Helmreich (2014, 175; see also Paxson 2008) microbes are also understood through attention to place, this time in reference not to disease but to cheese making, where the perceived value of microbes is linked to “their potential to trace a tangible, material connection between their cheese and the place—the environment, the land, the grasses—on which, or from which, it comes into being.” In this context microbes are markers not of disease, but of a unique (and marketable) quality of taste, however in both cases the meaning of microbes (and the implications of particular human-microbe entanglements) can only be understood through an attention to place (*terroir*) and an act of human-microbe encounter (infection or consumption). This reading of microbes as embedded within *terroir*, as described by Paxson and Helmreich, is one which resonates with geographical scholarship. As they note, “French winemakers have long argued that the ‘place’ of *terroir* is not reducible to geography [understood here in a Cartesian sense] but emerges from conjunctions of environmental conditions and cultural practices carried out in a particular locale over the duration of successive human generations – from putting in place a durable model of human–ecological collaboration” (Paxson 2008, 176). Such a reading resonates strongly with Canguilhem’s concept of *milieu*, which, drawing on the work of geographers like Vidal de la Blanche, he describes as “always being shaped by and, in turn, shaping the human” (Elden 2019, 54; see also Philo 2007, 85, 89, 93 (note 8), 94 (note 22)). Similar ideas of co-production, human and nonhuman entanglement, and the challenges of living together, are now common parlance amongst scholars in the geohumanities, particularly those engaged in new materialist and posthumanist thought. What is striking about reading Canguilhem’s work and the accounts of scientific research from a similar period is the enduring nature of these concerns.

## TRACING MICROBIAL AGENCY IN THE ARCHIVE

In order to evidence this enduring concern with the co-production of human and viral lives in medical research I draw on a combination of: (a) three published accounts of the CCU written by those who worked there; (b) a collection of 34 oral history interviews with those who worked in the CCU; (c) a selection of published scientific papers and correspondence from medical journals c.1960–1965 (the time when the unit first successfully isolated and cultured viruses *in vitro*); and (iv) press cuttings and (v) visitors’ books from the CCC archive. An introduction to the CCU and its work was found through three published histories (Source A), *Cold Wars* (Tyrrell and Fielder 2002), *The Common Cold* (Andrewes 1965) and *Harvard Hospital and its volunteers* (Thompson 1991), written by its two former directors (Tyrrell, Andrewes) and a long

serving administrator (Thompson). *Cold wars: The fight against the Common Cold* combines a brief history of the Common Cold with an account of the establishment of the CCU in 1946 and its subsequent work, and is co-authored by David Tyrrell, director of the CCU from 1957 to 1990. As part of the research for *Cold Wars*, between 1994 and 1997 Tyrrell conducted a series of 34 oral history interviews (Source B) with former staff and researchers from the CCU, the recordings of which are now archived at the British Library (“Common Cold Unit Recordings,” shelfmark C1038). These recordings contained personal reconciliations of some of the challenges of working with Common Cold viruses absent from more formal scientific reporting. Thirdly I draw on a series of scientific publications and associated responses published by the CCU in leading medical journals between 1960 and 1965, following their first attempts to isolate and culture cold viruses invitro (Source C), here critical responses to their work, and the uncertainties which surround its interpretation, serve as further evidence of the ways in which viruses and their effects exceed human understandings and explanations. Finally, additional insights into the CCU as a space where people worked and volunteered were drawn from the accounts of volunteer experiences found in the collections of press cuttings (c. 1951–1957, Source D) and visitors’ books (c.1981–1985, Source E) from the archives of the National Institute of Medical Research. A summary of the sources consulted is provided in Table 1.

My approach to these materials is inspired by recent moves in historical geography to work with what Mills (2013) describes as “fragments, objects and ghosts” as a means of resisting simple, official histories and, key to my concerns here, acknowledging nonhuman agency. There is not scope here to do justice to the full breadth and depth of themes which emerge from a sustained engagement with these materials, although my longer-term engagement with the oral history materials in particular reveals interesting themes about the economic challenges of

TABLE 1  
Summary of Sources Used

Source	Description of material	Location/References for any papers or articles cited
Source A	Published accounts of the CCU written by those who worked there	Andrewes 1965; Tyrrell and Fielder 2002; Thompson 1991.
Source B	“Common Cold Unit Recordings.” 34 Oral history interviews conducted by former unit director, David Tyrell between 1994 and 1997 as part of the research for <i>Cold Wars</i> .	British Library “Common Cold Unit Recordings,” shelfmark C1038
Source C	Published papers from the Common Cold Unit c. 1960–1965 and correspondence from the British Medical Journal c. 1963–1965	Tyrrell et al. 1960; Tyrrell and Bynoe 1961; Tyrrell 1963; Taylor-Robinson and Bynoe 1964; Banham 1965; Mulkern 1965; Tyrrell, 1965
Source D	Common Cold Unit Press Cuttings Folder c. 1951–1957	Box 137, CCU, National Institute of Medical Research, London, including Moynihan 1950; Press cutting 1951
Source E	Common Cold Unit Visitors’ Books, c. 1884–1988	Box 137, CCU, National Institute of Medical Research, London

resourcing Common Cold research, the sometimes challenging behaviour of clinical trial volunteers, the highly gendered framing of the interviews despite the interviewees including prominent female scientists and researchers, and the more-than-human composition of tissue culture research. In this paper I chose to focus in particular on moments where viral recalcitrance—its refusal to align smoothly with the scientific explanations and social norms through which those at the CCU sought to situate it—serves as testimony to its more-than-human agency.

Firstly, my approach seeks to draw together fragments, as it seeks to supplement published histories of the CCU with alternative accounts drawn from oral history interviews with CCU scientists and technicians (Source B), contemporary scientific papers written by those working at the CCU (Source C), and the reflections of visitors as captured in the newspaper cuttings (Source D) and visitors' books (Source E) assembled in archive collections. Secondly, my approach is concerned with objects in as much as it seeks to grapple with the material affects of human-viral encounter and offer a "more-than-representational" reading of the archive (Mills 2013; Lorimer and Whatmore 2009). To this extent my approach is broadly aligned with the traditions of discourse analysis, but in this paper rather than seeking to offer an overview of key themes emerging from these sources, it instead seeks to read them somewhat against the grain in order to draw together those moments where viral agency is brought to the fore. In practice this means when I read and listened to materials, alongside more conventional thematic coding, I sought to attune myself to accounts of viral recalcitrance (where the virus disrupts or refuses to comply with the role an experimental protocol sets out for it), sympathetic to Canguilhem's instance on the *élan vital* inherent in all living forms (for a discussion of Canguilhem's engagements with vitalism see Philo 2007; Elden 2019, 35–43), and treating the Common Cold virus as a quasi-object (Bingham 1996), co-constitutive of the social and experimental settings within which it is embedded. The descriptions of the day-to-day work of laboratory researchers and technicians (Source B) were particularly useful here, as well as Tyrrell's accounts of his struggles to cultivate viruses *in vitro* in the early days of the unit (Tyrrell and Fielder 2002, Source A).

The analysis below is divided into three sections. The first draws on scientific papers (Source C) and extracts from the oral history interviews with researchers and laboratory technicians (Source B) focusing on early work of the CCU (c1961–1965), noting in particular how the emphasis on scientific achievements seen in the interviews with scientists (and indeed in the questioning of the interviewer and unit director, David Tyrrell), contrasts with the everyday descriptions of the labour intensive and challenging work of the technicians trying to cultivate Cold viruses *in vitro* (see British Library "Common Cold Unit Recordings," shelfmarks c1038/11, c1038/22, Source B, as well as Tyrrell and Fielder (2002) *Cold Wars* 87, Source A). The second section considers the challenge of making sense of the results of CCU experiments, drawing on an exchange between CCU scientists and a critic of their work that took place in the *British Medical Journal* in 1965 (Source C), which draws attention to the many uncertainties which surround scientific understanding (both then and arguably now) of the interactions between human immune systems and viruses. The third section looks at the interplay between virus and volunteer, drawing on two separate examples: The Seal Island experiments of 1951 (Sources A and E); and the experiences of volunteers are reported via press coverage and visitors' books from the early 1980s (Sources D and E). Here again the non-scientific sources draw attention to moments of experimental failure and viral recalcitrance. In each case I probe how the relationship between experimental setting, virus and volunteer generated a particular experience of catching Cold which resonates with Canguilhem's suggestion that disease might be a



positive innovative experience. In the discussion that follows, I then draw out some further observations to illustrate how Canguilhem offers a useful critical lens on contemporary posthumanist scholarship in health and medical geographies.

### FROM THE CLINIC TO THE LABORATORY: VIRAL ISOLATION, CULTURATION AND CHARACTERISATION

Canguilhem argued that the germ theory of disease was so successful because it provided a means of localising the pathological within a specific non-human agent. The normal and the pathological could be determined through the presence and absence of firstly bacteria and later viruses; germs “embodied an ontological representation of sickness. After all, a germ can be seen, even if this requires the complicated mediation of a microscope, stains and cultures, while we would never be able to see a miasma or an influence” (Canguilhem 1991, 40). Then, once the agent of disease could be identified, it could be tackled: “to see an entity is already to foresee an action” (*ibid.*). This belief arguably characterised much of the early work of the CCU, which sought to find ways of extracting, rendering visible, and characterising viruses associated with the Common Cold, influenza and acute respiratory disease. Based near Salisbury in the UK, the CCU combined laboratory research with clinical trials using human volunteers to test for the presence or absence of viral agents and the efficacy of Common Cold remedies. CCU scientists describe themselves as early pioneers in growing (culturing) viral cells outside of their human hosts, primarily in human and rhesus- monkey tissue cultures (Tyrrell and Bynoe 1961, Source C), and as playing a key role in identifying and classifying viral sub-types.

Through this early CCU research, humans were learning to work with Common Cold viruses in new ways. Where before humans could only catch Colds and experience symptoms, now CCU scientists could observe, extract and culture relations with viruses, enabling new forms of interaction. A laboratory technician who worked at the CCU describes one daily routine:

some afternoons we cultured these HeLa cells [an immortal human cell line used in scientific research derived from cervical cancer cells] [there were these] centrifuge bottles - big heavy walled round bottles, and you put them in the hot room - and they [the cells] stuck to the sides and grew very thickly. [T]he medium would be something that would amuse people these days I think - in the tissue culture room we had a big butchers hook and you hooked the uterus up on there ... [the scientists] used to suck the amitotic fluid out of this uterus and then we filtered it ... and after we drained as much of that as possible they would take out the embryo ... we used to make beef embryo extract from that ... ground it all up ... so the fluid which you used to start with for the HeLa cells was bovine amniotic fluid, beef embryo extract and lactalbumin hydrolysate which came as a powder and you mixed that up with Gey's solution [a balanced salt solution used for washing tissues and cells] ... you had to add calcium and magnesium later ... I suppose we must have put some antibiotics in but I don't remember which ones ... and then he [scientist] would grow his adenoviruses in these. (Oral history interview conducted by David Tyrrell in 1994 with CCU technician, held at the British Library “Common Cold Unit Recordings,” shelfmark C1038/03, transcription author's own, Source B)

This thick description of the labour involving in preparing and inoculating tissue cultures is characteristic of the oral history interviews with CCU technicians and some researchers (see also “Common Cold Unit Recordings,” shelfmarks C1038/06, C1038/11, Source B). Listening to the archival recordings brings to life how a new ecology was being



created, with new kinds of organic, inorganic and chimeric inhabitants, including not only the viruses, but tissue-cultured monkey and human cells, immortal cell lines, slaughtered cow parts and human technicians. This description of laboratory ecologies stands in stark contrast to the more formal accounts of these processes seen in contemporary scientific publications, for example:

To exclude the presence of known viruses the washings were then introduced into tissue cultures—in early experiments HeLa cell and human embryo lung cultures were used. Later we turned to cultures of human embryo kidney and monkey kidney cells maintained in medium 199 and tested for haemadsorption [reaction to being placed in direct contact with red blood cells]. (Tyrrell et al 1960, 235, Source C)

Within this novel viral ecology, new ways of classifying the kinds of viruses which could cause Common Cold-like symptoms began to emerge, including “parainfluenza viruses, respiratory syncytial viruses, and rhinoviruses” (Tyrrell 1963, 496, Source C). Significantly, different viral strains—once identified solely by their symptomatic effects on human hosts—were then further classified after their environmental preferences; M (grown on monkey kidney) and H (grown on human embryonic or human malignant [cancerous] cells) (Taylor-Robinson and Bynoe 1964, Source C). As CCU scientists reported in the *British Medical Journal*, “our results so far suggest to us that the strains we are growing cover what might be called a “spectrum of cultivability” ranging from those much like JH and 2060, which will grow readily in human and monkey kidney, via strains which will grow in human cells only, to others which will grow only imperfectly in human-kidney cells” (Tyrrell and Bynoe 1961, 396, Source C). In this way the challenging labour of growing viruses in the laboratory described by the CCU technician resolves in formal publication into a new way of classifying or understandings viruses based on their preferred tissue culture, or *milieu*.

This nomenclature reflects how the work of tissue culture created a new history and geography of viruses. It also marks a moment where the history of Common Cold viruses is becoming separated from the history of disease. As Canguilhem noted, *viruses now have an ontological existence outside of the organism*. The experiments at the CCU laboratories created a new context for the human-viral relationship, effectively separating out the *terrain* (the patient’s body and proclivities) and virus, and the experience of infection from the supposed agent of disease. This in turn generated new ways of relating to the viruses. Some viral strains took on an almost pet-like status within the CCU, and were named after individuals they were sourced from (Greenhough 2012a). Encountering common cold viruses in the CCU is very different to encountering them as an infection, and correspondingly the human-virus relations emerging within the laboratory are arguably not representative of those in other locations, including infected bodies. This poses biopolitical challenges in terms of drawing an easy association between viral presence/absence and disease.

### THE MYTH OF THE HEALTHY CARRIER OR “HOW TO LIVE DIFFERENTLY WITH VIRUSES”

Despite the progress made by the CCU and other laboratories culturing and classifying different viral strains, this increased knowledge of viral sub-types seemed to have little effect in actually curing disease. One critic, writing in the *British Medical Journal* (BMJ), suggests that,

In the era of Pasteur we have been asking the bacteriologists, and now the virologists, for the answers to our questions on most acute diseases; they have never failed to find the “causative agent.” Unfortunately these appear to be omnipresent, irrepressible, and immune to total elimination. In fact they come back more virulent and aggressive after each sortie of ours to control them. We were taught as students that infection depended on bacterial virulence and host resistance. Is it not time that we studied the latter state in the present context? (Mulkern 1965, 595, Source C)

Mulkern (1965) uses the figures from a piece of research undertaken by *Medical Research Council Working Party on Acute Respiratory Infections* (Banham 1965) (Source C) to calculate the number of healthy contacts (people tested for viruses due to their close association with someone displaying symptoms of virus infection) who also tested positive for viral presence, suggesting that on average for every two cases there could be found one (asymptomatic) healthy carrier. He continues:

One would like to know more about these shadowy contacts. Did they develop to illness? If so, they should move into the “case category.” If not, then they could be endowed with the mythical and neglected property called host resistance. These people should become the material to study [...] studying the neglected healthy contact not in the hospital ward nor in the laboratory of bacteriology or biochemistry, but in his [sic] home, in his [sic] work, his [sic] hobbies, his [sic] diet, his [sic] mental pursuits. In a word, we should study the ecology of this healthy contact if we wish to find a sane and satisfying answer to acute respiratory disease. (Mulkern 1965, 595, Source C)

Mulkern’s critique of the study, and by inference the kind of viral characterisation work undertaken at the CCU, echoes Canguilhem’s critique of the focus on pathogenic agents in medical research. It is also, towards the end, uncannily reminiscent of calls for a more personalised approach to questions of health and disease characteristic of contemporary approaches to medical humanities and health geography, albeit in Mulkern’s case also a notably gendered concern. That said, while health geographers emphasise the points where “microbes inevitably meet the instabilities of embodiment, uncertainty, and exhaustion, producing complex personal histories that span a range of places, spaces, and scales” (de Leeuw et al. 2018, 287), for Mulkern it is the point where viruses meet resistance that calls for closer scrutiny.

The asymptomatic or “silent carriers” cited by Mulkern reflect the Canguilhem’s argument that seemingly the presence or absence of a viruses does not establish a cold, or vice versa: “[a]n inapparent infection is not an inapparent disease” (Canguilhem 1991, 293, note 17). What is interesting is how Canguilhem’s reflections in his discussion of Bernard’s experimental pathology neatly bring together the concerns of Mulkern, and notably *his focus on scientific uncertainties around immunity as the key problem for medicine*, and the complex personal histories alluded to by de Leeuw et al (2018). Canguilhem (1991, 293, note 17) suggests that “the often prolonged latency of certain degeneracies, the inconspicuousness of certain infestations or infections leads the physicians to regard the direct pathological experience of the patient as negligible, even to consider it as systematically falsifying the objective pathological fact.’ In both cases the implication is where the experience of the patient does not align with the established biological facts (i.e., the presence or absence of a virus or its traces), the biological facts take precedence.

Canguilhem (1991, 40) suggests that while there is an understandable appeal in the belief that the key goal is to isolate and eliminate the pathogenic agent, “the recognition of the specific and individual role of *terrains* (the state of an organism with regards to its resistance to pathogenic

agents or its predisposition to different diseases)” has challenged this simple strategy. Furthermore, the way in which science and society characterise viruses (and those who carry them) as pathogenic agents to be eradicated (or quarantined or otherwise set apart from the rest of the population) it is at least in part a value distinction (Wald 2008; Craddock 2000), based on an understandable desire to be able to localise the problem and treat it. As Povinelli (2017) reminds us, for all its monstrous and mutating potential, the figure of the virus is all too readily co-opted onto biopolitical (and geopolitical, see Braun 2007) agendas. Let us return then to the figure of the “healthy carrier.”

Tyrrell (1965, 882, Source C) disagrees with Mulkern that these properties of immunity and host resistance mean there is no need for a “basic knowledge of the causative agents of infectious disease progress” (e.g., the kind of viral characterization and classification work done at the CCU). Rather he suggests that the solution lies in a combination of laboratory and clinical studies, suggesting that there is “a recurring interaction between the clinician and the virus research worker, and on several occasions clinical observations indicated probable conclusions which laboratory work confirmed, and on others laboratory studies drew attention to clinical features which had previously been overlooked” (Tyrrell 1963, 494, Source C). Canguilhem equally stressed the important role of clinical observation in defining a state of disease (seen in his influence on Foucault, see also Elden 2019, 27). For Canguilhem, because disease or the pathological state is fundamentally defined as the subjective experience of the patient, the definition of disease always begins in the clinic, even if, at a later point that clinical observation becomes the basis for a laboratory investigation which leads to the identification of one or more causative agents.

Despite challenging Mulkern’s response, nonetheless Tyrrell and his colleagues also recognized the importance of understanding host resistance. CCU scientists explored how the presence and absence of antibodies affected the development of virus-induced symptoms. Studies at the CCU therefore explored the levels of antibodies present in volunteers before and after inoculation with various virus strains (Taylor-Robinson and Bynoe 1964, Source C). However, findings again pointed to more complicated relationships between virus, antibody and human host. In general, study participants who developed Colds had lower levels of antibodies, however, there were also volunteers who had low or no levels of antibodies for a particular virus, but who still failed to be infected by it (or at least showed no symptoms). Researchers suggested that such cases were either the result of an error in the inoculation process or the cells of those volunteers possessed some other quality, in addition to antibodies, which made them resistant to Cold viruses (Taylor-Robinson and Bynoe 1964, 543, Source C). Antibodies were framed as a new ontological, quantifiable entity which could be used to sometimes track the presence and absence of both viruses and Colds, but again the picture is incomplete and the role of the host body (*terrain*) in the form of “non-specific resistance of cells” (Taylor-Robinson & Bynoe 1964: 543, Source C) resurfaces. It seems that the researchers could not understand the Common Cold by simply isolating and naming the virus responsible. Instead, what emerges through this exchange in the BMJ is a recognition that both infection and the experiences of Cold symptoms are the result of a complex interaction between different strains of virus and different host bodies (and their associated levels of antibodies and cellular resistance).

The question of the healthy carrier therefore confounds an easy association between virus and disease. It again brings into question the earlier assumption we noted that the normal, natural and desirable state is that of being uninfected, and suggests there are ways—alternative human-viral ecologies—in which humans and viruses might co-habit that are not always characterised by (or

easy to characterise as) pathological consequences for the human concerned. Drawing on evolutionary theory, Canguilhem suggested that “it is normal for the nondomesticated and nonexperimentally prepared living being to live in an environment where fluctuations and new events [including viral infection] are possible” (Canguilhem 1991, 183). Equally, the human does not just submit to the pathogenic agent any more than any other environmental factor, instead “he [sic] structures his [sic] environment at the same time as he develops his [sic] capacities as an organism” (Canguilhem 1991, 284). These ideas anticipate much of the recent thinking around the human microbiome, which advocates a more ecological perspective, seeing the human as a superorganism and microbes as something which might be as often cultivated as eradicated (Yong 2016; Lorimer 2020). The inability of the CCU scientists to derive a definitive quantitative indicator of either the pathological state or resistance to it (immunity) also gestures towards the specific version of vitalism at the heart of Canguilhem’s work, namely the inability of living beings (or assemblages thereof) to be reduced to simplified mechanical processes, which in turn can be used to justify systematic, seemingly rationale biopolitical actions (Hinchliffe et al. 2013).

#### VIRAL EVOLUTION, HUMAN RESILIENCE AND EMERGENT HUMAN-VIRAL ECOLOGIES

So far we have noted how both growing viruses in the laboratory, and the figure of the healthy carrier, offer examples of non-pathological engagements between humans and viruses, closely linked to a change in the situatedness (*milieu*) of the human-virus interaction and the particular human body (*terrain*) in question. In the first instance the virus is moved into a new location (the laboratory), in the second case we see the host-virus relation play out differently according to the particular host-body (*terrain*) which it infects. What we have yet to note is that the situation (*milieu*) and host body (*terrain*) are not the only things that change as a result of host-virus interaction. As Canguilhem (see also Latour and Woolgar 1979) reminds us, re-locating viruses in the laboratory also involves re-locating them in a new environment where conditions are very different: “we must not forget that the laboratory itself constitutes *a new environment* in which life establishes norms whose extrapolation does not work without risk when removed from the conditions to which these norms relate” (Canguilhem 1991, 149, emphasis original).

What this means in practice is that both the viruses cultivated in the CCU, and the human volunteers used to test them, will be operating in a new context, one which, according to Canguilhem, is less hostile than the world outside: “they are sheltered from the brutal variations and demands of adapting to the environments” (*ibid.* 183). In producing the laboratory-grown Cold viruses the CCU is also, according to Canguilhem, producing their pathology. Here pathology is defined not as a proxy for disease, but as a deviation from an environmental norm: “by any external criteria the laboratory is a pathological situation, in that it is unusual – or at least a statistical divergence from the usual *milieu* of the living being” (Elden 2019, 21). While the CCU aimed to establish the existing rules (norms) of viral infection through the process of extracting these viruses and culturing them *in vitro*, what it effectively achieved was to generate new norms as (at least some of) the viruses gradually adapted to their new *milieu*. Consequently, “[t]here is an irony in using that setting as the context for the examination of the living being, to try and derive an understanding of what is normal” (*ibid.*). For Canguilhem, drawing on the insights of von Uexküll, to show that, “a living being can be studied in an experimentally

controlled environment” is to “make a *milieu* for it, while recognising that the living being also makes that *milieu*” (Elden 2019, 54). Canguilhem stresses how disease is a function of the relationship between organism (in this case virus), host body (*terrain*) and environment (situation/*milieu*), and more specifically disease arises as a result of either a failure of an organism to adapt to a new environment, or an environmental change which makes the environment one in which the organism can no longer thrive.

The impact of a novel *milieu* is reflected in the challenges faced by scientists working on the early tissue cultures at the CCU, which included a continued refusal of the virus to colonise prepared tissue cultures (Greenhough 2012a). This suggests that at least initially the laboratory environment was one in which the cultured viruses struggled to survive. For example, in his account of the history of the CCU, *Cold Wars*, Tyrrell (Tyrrell and Fielder 2002, 88; Source A) describes how at a progress meeting a year after arriving at the unit he “could not really say we had found out how to grow the virus properly.” Later experiments, which compared the viruses which had been cultured in the laboratory with their “wild” cousins, found that the cultured viruses had also become less virulent.

In one 1950s experiment, twelve volunteers (nine university students from Aberdeen, as well as an ex-police super-intendent and his wife who were in charge of the party) were isolated on a remote island in the Scottish Highlands (Seal Island) for a period of three months (Andrewes 1965; Thompson 1991, Source A). In theory this would decrease their immunity and make them more susceptible to Colds. However, at the end of the isolation period, when the island volunteers were then introduced to other volunteers infected with the CCU’s pedigree viruses, not one contracted a Cold. It was not until a local crofter with a “wild” Cold was persuaded to visit the island that five out of the twelve volunteers contracted and displayed symptoms of his Cold. A commentary on the experiment in the *Chemist and Druggist* suggested that, “artificial Colds are not representative of natural Colds as regards infectivity and suggested that this may be due to the attenuation of the infecting organism during storage or transfer” (Press cutting 1951, no page, Source D<sup>5</sup>), echoing Nicolle (a French bacteriologist cited by Canguilhem) who writes that, “the phenomenon changes in our hands” (Nicolle cited in Canguilhem 2008, 16). In other words, the way in which viruses were cultured at the CCU generated biological as well as social changes in human-virus interactions as the virus became attuned to its new environment.

Furthermore, it was not only the viruses that found themselves having to attune to a new environmental context. As Philo (2007) observes, Canguilhem stresses how humans too find their biological norms changed as they interact with and change their environment. Canguilhem’s key point is that what marks the distinction between the normal and the pathological—i.e., whether or not infection by a virus is seen as a source of ill-health—is not a laboratory test marking the presence of a virus, but the patient’s subjective evaluation of their own state; whether they identify “a feeling of life gone off-course.” In order to explore how this applies at the CCU, we need to step outside of the tissue culture laboratory and consider other agents in play, including the human volunteers who participated in the CCU’s clinical trials and volunteered to be exposed to viral agents.

Let us return for a moment to the case of the Seal Island experiments, where we can speculate as to whether the experimental island environment might have changed the volunteers in much the same way as the laboratory environment might have impacted the viruses. This was, after all, the hypothesis behind the experiment. In theory isolation from the mainland population is supposed to have decreased the island volunteers’ immunity (i.e., they would have lacked exposure

to the current viruses circulating, an exposure which would have caused them to develop antibodies). On the other hand, the experience of staying on a beautiful remote Scottish island with a good supply of healthy food and outdoor activities might be seen as idyllic, health promoting and even therapeutic (Kearns and Gesler 1998; Greenhough 2012b; Conradson 2005), increasing the volunteer's resilience to colds. Thompson (1991, 113), the CCU's long serving administrator, for example, describes how,

Many evenings were spent around a roaring peat and wood fire playing bridge, having long discussions or singing to the accompaniment of the guitar and mouth organ. Our wireless sets kept us right with the time and day of the week, which was of little significance to us that [sic] it was frequently forgotten [...] we were all agreed this had been the most unusual and enjoyable holiday.

Accounts of contagious disease are quick to demonise certain sites and spaces as incubators of viruses (Craddock 2000; Wald 2008), but other accounts also recognise particular configurations as beneficial. Both Seal Island and the CCU research site where most of the human volunteers were housed during the CCU's clinical experiments, could be seen as archetypal therapeutic landscapes, combining "magnificent scenery, water, and trees," "feelings of warmth, identity, rootedness, or authenticity" and "familiar, daily routines" (Kearns and Gesler 1998, 8).

Not unlike Seal Island, the CCU was located in beautiful countryside and is often described as having a holiday camp atmosphere. For example, a journalist who wrote a story about their participation in the trials describes their arrival:

From the "Welcome to Harvard" file on the living-room desk, we learn that we can have, free, a pint of beer or cider a day, newspapers and magazines, a game of golf, skittles, shove-ha'penny, darts, cards or cribbage ... the hospital library has 1500 books ... we can go for long walks ... No wonder the word has got round that this is the perfect, and quiet, holiday camp. (Moynihan 1950, 10, Source D)

This is echoed in many of the visitors' books comments left by those who participated in later trials: for example, "once again a really super stay here at the CCU" (Visitors' Book, Common Cold Unit 1988, Source E); "I have enjoyed my second time just as much as my first, whoever read this book after me, I hope you have as much fun" (Visitors' Book, Common Cold Unit 1988, Source E); "We have had a fantastic rest from the tribulations of the 'world outside and have never felt better" (Visitors' Book, Common Cold Unit 1984–1986, Source E). Although this 'holiday atmosphere' was arguably something the CCU actively sought to cultivate as part of their recruitment strategy (Greenhough 2012b), the fact they managed to do so suggests the possibility that catching a Cold can be enjoyable, or at least a small price to pay.

The environment is not only key in terms of impacting the resistance of individuals to Colds, it also shapes how the Cold itself is experienced. For Canguilhem, disease or ill health only occur when they prevent a living being from following their normal day-to-day routines; when their course of life is disrupted (Canguilhem 1991, 209). Taken out of their day-to-day lives and relocated in fully catered flats in the beautiful Wiltshire countryside, with nothing to do except relax, and maybe (if you were students) study a little, is arguably a very different context in which to have a Cold. For volunteers at the CCU the experience of being exposed to or even contracting a Cold takes on a very different meaning. Volunteers became caught up in the experiment. What previously might have been experienced as the "Cold from hell" turned into something to be



desired. Volunteers even went to considerable effort to develop Cold symptoms, sitting in drafty corridors or with wet feet to try and help the experiment along, bemoaning their lack of symptoms: “The irony of it. We remember with bitterness the Colds that we have done our best to prevent but caught, and then tried our utmost to get rid of. Splendid, rotten Colds that have kept us in bed, where with feeble, feverish hand, we reached for hot milk and whisky” (Moynihan 1950, 11, Source D). Those who did get a Cold, rather than bemoaning their lot, focused on the responsibility of collecting used tissues (measured by CCU staff as a quantifiable symptom): “I managed 35 tissues yesterday – my record” (Visitors’ Book, Common Cold Unit 1984–1986, Source E). It seems that, by seeking to isolate the pathogenic agent and intervene in its passages to and from human hosts, the CCU generated new (healthier) ways of living with viruses, changing the environment in which they were encountered. What the CCU offers therefore is insight into different ways of living with viruses—new norms—as researcher, as lab technician or as volunteer.

### DISCUSSION: A VITALIST’S POST-NATURAL HISTORY OF THE COMMON COLD VIRUS

While Canguilhem defended his doctoral thesis on *The Normal and the Pathological* in 1943, as Elden (2019, 13; see also Philo 2007) notes, “he has much to offer contemporary concerns.” A close reading of his work alongside emerging developments in virus research in the same period suggests a longstanding appreciation of the complexities of human-virus encounter often forgotten in the grip of contemporary microbiomania (Helmreich 2015). A consideration of Canguilhem’s “vitally human medical geography” (Philo 2007) alongside a more-than-human inflected reading of the CCU’s work serves to remind us of the enduring nature of these concerns, both when Canguilhem was writing in the 1940s–1960s, and in the earlier antecedents to these ideas which Canguilhem traces back to Pasteur’s (1880) work on immunity and Portier and Richet’s (1902) work on anaphylaxis.

Equally, the early CCU work marks an interesting point in the postnatural history of viruses, when they shift from being an invisible cause of symptoms to being a measurable, extractable, entity. At the CCU both viruses and their human hosts learn to thrive in a way which challenges the automatic assumption that the presence of a virus signifies an absence of health. While popular belief saw viruses as a threat, advances in virological research (aimed at conquering that threat) were simultaneously allowing scientists and volunteers to encounter, cohabit with and understand viruses in new and multiple ways, and historians of science (like Canguilhem) to recognise and reflect on the challenge of knowing life.

Canguilhem’s work and the CCU example help us critically engage with the role of infection and associated symptoms in drawing lines between the “normal” and the “pathological” and argue for a closer attention to the “situatedness of infection” (see also Philo 2007) and how scientific (as well as economic, see Wallace 2009) practices create distinctive forms of human-virus ecology. As Canguilhem suggests, and the instances of the non-symptomatic healthy carriers found by the CCU and its critics prove, the presence or absence of viruses is insufficient for distinguishing between health and disease, normal and the pathological: “the pathological state is not a simple, quantitatively varied extension of the physiological state, but something else entirely” (Canguilhem 1991, 89). Furthermore, “not all pathogenic germs determine an infection” (Canguilhem 1991, 282), and not all those infected by the CCU’s pedigree viruses saw their



illness as pathological. Canguilhem's work leads us to consider the specific materialities, environments and temporalities of microbes and bodies, and the conceptualisations of health and disease they inform. Indeed, characteristic of Canguilhem's historical epistemology is, Méthot (2013, 114) argues, an attention to the ways in which "the formation, transformation, and rectification of concepts [...] is intrinsically bound with the experimental, material, technical, and cultural contexts in which concepts are operationalized." Canguilhem thereby anticipates the demand for more personalised and ecological approaches to medical research, health geography and the geohumanities. This approach has much in common with recent posthumanist work, which like Canguilhem, sees health and disease as a continuum, "disease is not so much absent or present, but a continuing, if virtual, presence/absence" (Hinchliffe et al. 2013, 540).

Furthermore, a consideration of the range of contexts through which these encounters between humans and viruses take place—from laboratory tissue culture, to the bodies of volunteers, to a remote Scottish island—suggests a need to think through the ways in which viral *milieu* might also be conceived at different spatial scales (see also Philo 2007, 91). For example, we might think about how viral presence or absence even at the same site might become more or less apparent depending on scale. An infection detected in a sample taken to a laboratory could fail to register in a patient's everyday experience and be invisible at the level of the population. Equally, while an individual patient might show all the signs and symptoms of viral co-presence, tests in the laboratory may fail to detect a microbial presence to which these can be attributed.

Recent posthumanist work also emphasizes the need to conceptualise disease as emerging out of particular entanglements of social, political, economic, cultural and multispecies relations, leading to the recognition of "tipping points" (Hinchliffe et al. 2013) or the possibility of dysbiosis (Lorimer 2017; 2020). In contrast, Canguilhem's humanist tendencies see him understanding the tipping point as one established through the experiences of the patient (see also Philo 2007). This, in turn, has *implications for understanding the limits researchers and clinicians might face when seeking to use scientific knowledge to tackle infectious disease (and perhaps those posthumanists might face when seeking to translate their work to wider audiences)*. For Canguilhem ill-health is a product of a relationship between patient and environment, and is defined, at least in the first instance, qualitatively, as a feeling of life gone wrong or off course. In other words, for Canguilhem what defines the "breach point" or "dysbiosis" is the experience of the (human) individual or organism affected. Perhaps the fact that the CCU volunteers understood that getting a Cold was par-for-the-course of the experiment served to make the experience more one of work than illness. Furthermore, "not all pathogenic germs determine an infection" (Canguilhem 1991, 282). *Consequently, we cannot tackle infectious disease by focusing only on eradicating the pathogenic agent, rather we need to take into account the specific human terrain (body) through which that infection plays out; what is livable for some can be devastating for others*<sup>6</sup>.

This then has *implications for our understanding of what constitutes normal and pathological viral entanglements, and the importance of the contexts (milieu) within which such decisions are made*. For Canguilhem disease and health are understood primarily through the specificity of patient experience, perhaps suggesting his work is more closely allied with those working in the geohumanities concerned with understanding disease as it emerges through complex personal histories (de Leeuw et al. 2018). Yet, *where scholars in medical humanities and health geography might look for the lived experience of disease beyond the clinic, for Canguilhem, the clinic is the site not only for the establishment of and imposition norms (as Foucault would later explore in depth), facts and certainties, but also their confoundment*. It is in the clinic where

Canguilhem (a trained physician) encountered the specificities of human experience and the pathological exceptions from which (he insisted) would later be derived the healthy and diseased norms. This of course, lays open the path for posthumanist critique, but also opportunities for thinking through how the figure of the virus might too be thought through its relation to particular forms of bodily terrain.

It is striking, therefore, that while Canguilhem's humanisms lead him to direct attention to the specificities of human/patient experience, his problematic—the line between the normal and the pathological—and the sites to which he directs our empirical attention (including specifically the spaces of animal experimentation and the physiology experiment, Canguilhem 2008, Chapter 1; 1991, Chapter 3) equally bear witness to nonhuman agency and the vitality of viral life. Canguilhem does not emphasise nonhuman experience and agency directly, indeed questions of animal welfare and suffering receive scant if any attention in his analyses. Nonetheless, his careful consideration of the intra-action (Hinchliffe et al. 2013) of living being and situation suggests the question of bodily *terrain* and environmental *milieu* is troubling for human and nonhuman alike. *We might note how Canguilhem's work can therefore nuance contemporary posthumanist approaches to understanding infectious disease, through, for example, a consideration of the ways in which the laboratory is a pathological space for both the humans and the viruses involved.* The laboratory remains a novel (abnormal) environment, one to which both entities will need to adapt in order to survive. In this brief account of the CCUs history we find traces of these adaptations in both the labours of laboratory technicians developing new, carefully honed skills in tissue culture to create new ecological niches for viral strains, and the experience of the CCU volunteers, desperate to catch Cold, for whom infection is, at that moment, “a positive, innovative experience” (Canguilhem 1991, 186).

For all of those discussed here, most especially the researchers who worked, and sometimes lived at the CCU, infection and viral agency were not simply numbers, presences or absences, but co-habitants whose environmental preferences (for human volunteers or particular tissue cultures) were generative of a new kind of research environment and multiple ways for humans and viruses to co-exist. Such adaptations arguably anticipate contemporary forms of biological citizenship which deliberately seek out infection (see for example M. Brown 2006, 883 on bug chasers who deliberately seek out HIV infection; and on hookworm reintroduction Lorimer 2016, 2017, 2020) by stressing the need to pay attention to the situatedness of infection, or what Canguilhem might term its *terrain* and *milieu*. The case of the CCU research, and the struggles of scientists to get viruses to grow and replicate highlight how the practices of medical research define *new ontological entities* (viruses, antibodies), create *new ecological niches* (tissue cultures, volunteers) for viruses to occupy and offer *new ways of interacting with and relating to viruses* (as scientist, as lab technician or as experimental subject).

Finally, particularly telling is the extent to which at the CCU contracting a Common Cold became a positive, innovative experience. We need, of course, to remain conscious of the risk of offering an overly affirmative, “feel-good” (Last 2017, 73, see also note 3; Philo 2017, 257) account of the embodied, material experience of living with disease, indeed one of the strengths of Canguilhem's humanist tendencies is that these cause him to be “alert to the simple but troubling reality of individual human beings in pain” (Philo 2007, 89). Nonetheless, I remain curious about how at the CCU both viruses and their human hosts learn to thrive, in a way which challenges the automatic assumption that the presence of a virus signifies an absence of health. Surely here lies an interesting possibility, as human society struggles to learn how to live with

the #newnormal of the current COVID-19 pandemic. While popular belief may see viruses, especially Common Cold viruses, as a scourge of humankind, *advances in virological research have allowed us to encounter, cohabit with and understand viruses in new and multiple ways*. Health geographers have very effectively drawn attention to the ways in which structural violence can have pathological effects (Kearns and Reid-Henry 2009). The unusual holiday opportunity presented by the CCU suggests the opposite may also be true. Given the right environment, could it be that we might even enjoy a life thrown off-course?

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## NOTES

1. It is important to note that Canguilhem uses this account of a polarised way of understanding infectious disease—you are either infected or not—as a starting point for a critical engagement with medicine's seeming insistence on an absolute distinction diseased and healthy states. In other words, to challenge the assumption that you are either sick or well, but never both.
2. For Canguilhem *milieu* refers to the context or environment of an organism (Elden 2019, 20, 40–41) and plays a key role in establishing an organism's pathological state. Pathology is defined in relation to an organism's *milieu*, specifically when a change occurs in the organism, the environment, or both, which means the organism can no longer effectively inhabit its environment. While Canguilhem very much saw the human being (and other living beings) as coproduced through their relationship with their environment, he nonetheless retained a sense of the organism as a unit of analysis with a meaning or sense greater than the sum of its parts.
3. For an excellent collection of essays on this theme see Biehl and Petryna's (2013) *When People Come First*.
4. It is important to note here that Canguilhem's vitalism can be understood as more a moral insistence on "the importance of life beyond its reduction to a mere material form" (Elden 2019, 30) than a method for research, at least not to the point where isolating the vital essence of a being becomes the sole focus of academic endeavor (Elden 2019, 37).
5. It is also notable that while Andrewes (1965, 121–123, Source A) and Tyrrell (Tyrrell and Fielder 2002, 179–180, Source A) only devote 2–3 pages of their accounts of the CCU to the Seal Island experiments, Keith Thompson, a long serving administrator, devotes a whole chapter of his account *Harvard Hospital and its Volunteers* (1991) to the expedition, reflecting the different priorities and perspectives of those involved; for Andrewes and Tyrrell this was at most a "small success," for Thomas it was a prolonged period of experimenting with new ways of living without viral exposures.
6. This brings to mind Callard's (2020) recent writing around her experiences of long and supposedly mild Covid-19 infection.

## ORCID

Beth Greenough  <http://orcid.org/0000-0002-7351-2619>

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BETH GREENHOUGH is Associate Professor of Human Geography and Fellow of Keble College, Oxford, UK. E-mail: [beth.greenhough@ouce.ox.ac.uk](mailto:beth.greenhough@ouce.ox.ac.uk). Her research explores the social implications of scientific innovations in the areas of health, biomedicine and the environment, and the social, cultural and ethical processes through which humans and animals are made available as experimental subjects for biomedical research. She is co-author of *Bioinformation* (Polity, 2017) and *Health Geographies: A critical introduction* (Wiley-Blackwell 2017).