



## CHAPTER 8

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# The Badgers Have Moved the Goalposts!

In this final chapter, I will draw together the threads of the various stories traced throughout this book to provide some answers to how the UK got into the tangled mess that is the badger/bTB controversy, and make suggestions on how we might go about getting out again. I will discuss the changing nature of our knowledge about wild badgers in Britain; about the microbe *M. bovis*; about farming and animal health; about the disease we call tuberculosis; and about the complex social and ecological relationships between them. In Chap. 1 (Sect. 1.1), I provided a summary of ‘the science’ of badger/bTB, in terms of how our knowledge has changed since the early 1970s, as well as areas of scientific consensus and contestation in contemporary research on the topic. However, as we have seen throughout this book, the idea that science and/or technologies are fixed, authoritative resources that we can expect to simply provide ‘all the answers’ has repeatedly turned out to be a canard. To be crystal clear, this problem *needs experts* and what they know, about a world we (humans) live in, which—as we are seeing with accelerating environmental change—pushes back when we do things to it.<sup>1</sup> However, it also needs all involved to adjust their understandings of what ‘science’ is and how it can relate to policy—to understand that ‘experts’ come from multiple backgrounds and often disagree; that science is a process, not a thing; and that knowledge is often provisional, uncertain and subject to change. As the cynical comments of Lord Rooker (quoted in Chap. 7) suggest, inflated expectations can simply store up trouble for later when research provides some

answers (although not necessarily the expected ones), while also uncovering a plethora of new uncertainties and new questions.<sup>2</sup> As we have seen, they also open a space for misrepresenting ‘the science’ to support lobbying for multiple agendas, and for exploiting uncertainty to delay or avoid responsibility for policy decisions. My conclusions fall under four key themes: relating to the longer history of TB in humans and other animals; the history of wildlife conflicts in Britain; the changing ‘cultures of care’ of badger/bTB; and expectations of and around science, policy and society. Following these, I will outline some further questions that this work raises for researchers, and some suggestions for policymakers, politicians and others embroiled in this deeply sticky—but in my view, not insurmountable—problem.

### 8.1 TB IN HUMANS, OTHER ANIMALS AND ENVIRONMENTS

At the beginning of this book I discussed a core idea from the history of medicine which can help us understand the history of tuberculosis (a disease which has been with us for thousands of years)—that of disease ‘framing’. Historians understand diseases as specific constellations of physical symptoms, organised and explained according to changing conceptual models of the body, health and illness, which come into existence when people collectively agree upon and label them as such.<sup>3</sup> The diseases ‘phthisis’, ‘scrofula’, ‘consumption’ and ‘tuberculosis’ have been built, rebuilt and in some cases abandoned over the last few hundred years, while mutually shaping changing social, political, technological and scientific contexts in the process. TB as we understand it today gradually took shape, from a generalised wasting illness indistinguishable from cancer, to several lung diseases caused by specific microbes. Similarly, the history of bTB—a disease contested back and forth as like, yet unlike human tuberculosis—can be understood as part of a broader reconfiguration of the domains of human and animal health since the late nineteenth century.<sup>4</sup> Eventually, the argument was settled by framing bTB (caused by *M. bovis*) as an animal disease, of importance because it was zoonotic (also infects humans); while TB (caused by *M. tuberculosis*) was recognised as solely human. This enabled scientists and medical professionals to assign the two diseases, respectively, to the separating domains of veterinary and human medicine—in science, clinical practice and policy. By the mid-twentieth

century, bTB had been configured primarily as a cattle disease, and by the 1960s as one which had been successfully controlled by state-led animal health practices of ‘stamping out’ disease.<sup>5</sup>

Since the discovery of tuberculous badgers in the early 1970s, I think we have seen a further process of reconfiguring tuberculosis, this time towards an ‘environmental’ disease. Finding *M. bovis* in wild animals—primarily (although not exclusively) badgers in the UK, and a range of other mammals worldwide—disrupted the previous framing of bTB. It also brought new actors into the well-established domain of British animal health policy: professional ecologists (in government and academia), as well as naturalists and animal advocates, already involved with changing the social role of the badger. While they were new to bTB, these ecologists had their own understandings of microbes and infection from working with other wildlife diseases. Rather than infectious agents to be isolated and ‘stamped out’, disease ecology instead saw microbes as active elements of dynamically changing ecological systems.<sup>6</sup> This reconfiguration of bTB was aided by the development of new technologies for knowing wild animals in the field and their application by Ministry for Agriculture, Fisheries and Food (MAFF) researchers to following badgers and their traces. As we learned in Chaps. 2 and 4, once MAFF started looking for tuberculous badgers, they found more and more of them, changing their understanding of the scale and urgency of the problem—and in turn precipitating rapid policy action.

Recent years have seen rapid developments in biomedical technologies for rapidly detecting and diagnosing the presence of pathogenic microbes, including the notoriously difficult to detect mycobacteria, which are being tested and promoted by alliances of academics, NGOs, clinicians and private companies.<sup>7</sup> While these developments should be welcomed and I would agree that new tests are desperately needed, it would be deeply unwise to expect them to act as a panacea. There are two sets of reasons for this. First, earlier iterations of the badger/bTB debate involved similarly shared expectations that newly testing technologies could create a ‘live’ test for bTB in badgers, enabling MAFF to trace and eliminate the disease more accurately. When subsequent field trials indicated that the new test was not sensitive or accurate enough, MAFF’s policy strategy collapsed.<sup>8</sup> The second set of reasons is subtler, but also more fundamental. Existing regulatory structures for controlling bTB are based around the tuberculin test. This diagnostic practice involves the skilled measurement of a body’s inflammatory response to

the injection of an extract of dead mycobacteria—the size of the lump that appears.<sup>9</sup> In other words, for all its problems, the tuberculin test provides a measure of *disease*—the bodily interaction between a pathogen and the immune response of the body it infects.<sup>10</sup> By contrast, many of the new rapid diagnostic tests work through means such as detecting ‘biomarkers’, the presence of ‘bacteriophages’ (species-specific viruses which infect bacteria, including *M. bovis*), and polymerase chain reaction (PCR) techniques for detecting DNA.<sup>11</sup> Just as new technologies (such as radio-tracking, infrared sensors and camera traps) have made it possible for scientists to follow, see and know about the lives of wild animals in completely new ways, these testing technologies are changing how we perceive and know *M. bovis*. Scientists are looking for—and finding—the microbe in places where they had thought it was absent: in the bodies of cows cleared by tuberculin testing, in soil and slurry, and even within the bodies of single-celled amoebae.<sup>12</sup>

Scientists and public health bodies—most significantly the World Health Organization (WHO)—have started renaming bTB from ‘bovine TB’ to ‘zoonotic TB’, flagging the capacity of *M. bovis* to pass beyond livestock into many other mammals, including humans and wildlife.<sup>13</sup> Because these new testing technologies often measure the *presence of microbes* rather than the *presence of disease*, their findings are likely to further disintegrate the twentieth-century livestock disease of bTB, recognising the complexities of an infection that passes across and between humans, other animals and wider environmental systems. Since it was first recognised in the late nineteenth century, bTB has been framed and reframed—initially as a disease shared between humans and other animals; then into an animal disease; then into a zoonosis; and perhaps now into an environmental disease. Just as scientists and veterinarians increasingly advocate a ‘One Health’ approach, I believe there is great value in thinking more broadly across humans, animals and environments about tuberculosis—there are important lessons to be learned when the histories of bTB and TB are brought together. This has potential not just for biomedical topics such as diagnostics and vaccination, but for public health problems such as surveillance, regulation and co-infection; and for the social, cultural and political aspects of TB such as inequality, stress, nutrition, stigma and economic factors.<sup>14</sup>

## 8.2 WILDLIFE CONFLICT AND THE GREAT BRITISH BADGER DEBATE

My research has uncovered evidence of a long-standing ‘wildlife conflict’ (conflict between humans and animals as well as between humans about animals) involving badgers in Britain, at least a century before they were connected with bTB in cattle. Between the late nineteenth and mid-twentieth centuries, the social roles of these animals gradually shifted—from a ‘vermin’ animal (reviled, hunted and made to fight with dogs)—towards that of an iconic, British, charismatic wildlife species (to be valued and cared for).<sup>15</sup> In the 1960s the professional ecologists of MAFF’s Infestation Control Division (ICD)—charged with deciding whether animals were officially regarded as ‘pests’ by government—found themselves caught between the supporters of the Good and Bad Badger. ICD eventually brokered a policy compromise based on the idea of the ‘rogue badger’—aberrant individuals, to be eliminated, while the majority should be left alone.<sup>16</sup> This compromise was short-lived, as the Good and Bad Badger were strategically remobilised by badger advocates as they gathered a broad base of support for new protective legislation. Initially these campaigns gained little traction within government—until the discovery of tuberculous badgers made it necessary to create a legal framework that not only made the animals ‘killable’ for MAFF officers and government licensees, but also prevented their less ordered killing by others.<sup>17</sup> As the culling controversy continued into the 1980s and 1990s (intensifying since 2010) the Good and Bad Badger have survived, and are still alive and kicking in today’s mass media, where they have been further transformed through mutually exclusive framings of the bTB controversy. Alongside the older roles of ‘pest/vermin’ and ‘charismatic wildlife’, association with *M. bovis* has created new social roles for the badger as a disease vector. These include more specific roles as infected ‘guilty victims’ (to be excluded or destroyed); and for others as targets of ‘genocide’ via government culling policies.<sup>18</sup>

These arguments demonstrate the strong continuities between how people argued about badgers in the past and how they are arguing about badgers and bTB in the present. In particular, we see aspects of contemporary debates which have little or nothing to do with bTB, such as badgers’ habits of digging in awkward places, eating the wrong things and damaging crops. These continuities suggest that an underlying ‘wildlife conflict’ (comprising conflicts between humans and badgers and—more

importantly—conflicts between humans *about* badgers) precedes and drives today's badger/bTB controversy.<sup>19</sup> The entanglement of disease narratives with this underlying wildlife conflict is likely to have further polarised and politicised people's relations with the animals themselves—as attested to by contemporary research into wildlife crime and animal advocacy in relation to badgers.<sup>20</sup> It follows that bTB policy—and perhaps animal health more widely—would benefit from sustained engagement with research and practice on managing wildlife conflicts. While scientists are already investigating badger–human interactions in relation to 'biosecurity'—that is how to block or break the transmission routes between cattle and badgers—these should be understood as only one aspect of a wider wildlife conflict with deep historical roots.<sup>21</sup>

### 8.3 CARE AS A DRIVER OF CONTROVERSY

As we have explored the worlds and work of the three epistemic communities that have formed around badger/bTB (*animal health*, *disease ecology* and *badger protection*), we have seen how the knowledge practices (how they investigated the problem) of each of these were mutually shaped by 'cultures of care' developed in the processes of working together.<sup>22</sup> This analysis has drawn out the differences between these cultures of care, with respect to *whom* or *what* these groupings care about; whether care has been focused at the scale of individuals or populations; and what 'care' itself entails in practice. It has also drawn out the changing nature of these cultures of care as they have constantly reshaped themselves and each other, while also mutually influencing broader historical shifts in science–society relations and environmental, agricultural and animal politics.<sup>23</sup> This book has traced how ways of knowing and of caring about badger/bTB have changed since they were first connected in the early 1970s. For example, when MAFF's veterinarians and ecologists started working with naturalists to investigate the new problem of badger/bTB, they used similar methods of investigation—following organisms and their traces, and mapping their geographical distribution. Over time the methods and ideas of the two groups diverged, with veterinarians following a medical logic of case-based intervention; ecologists following one of randomised controlled experiments; and naturalists continuing to follow badgers, with an increasing emphasis on directly observing, interacting and empathising with wildlife. Since the late 1980s badger/bTB research has also drawn upon and contributed to the application of mathematical modelling in

epidemiology and disease ecology, a methodology which has particularly come to the fore since the (expensive) completion of the Randomised Badger Culling Trial (RBCT) field trial provided more empirical data for refining these (cheaper) models.<sup>24</sup>

The contingent and changing nature of these cultures of care has also become clear as we traced the shifting alliances between and within these three epistemic communities over policies of bTB control. From the breakdown of an early consensus over the use of Cymag to ‘gas’ badgers in their setts, through disagreements between badger advocates about the ethics of killing badgers during the RBCT, to today’s deep polarisation over culling, points of fracture have manifested over what it means *to care* in the first place. Participants in these debates have agreed—and disagreed—that technologies and practices of killing, catching, restraining and documenting animals could be ‘humane’ or not, marshalling evidence drawn from the knowledge practices of their own epistemic community. For some, working ‘humanely’ meant that minimising suffering always comes before preserving life, making killing (animals) a central act of care; for others the opposite is true, making killing the ultimate cruelty. Similar points of fracture/alliance have emerged, dissolved and been rearranged around the relative importance of individuals against populations, societies or wider environments; of economic constraints and who bears the costs of disease control; and of building reliable knowledge—‘good science’—as a goal in and of itself.<sup>25</sup> As we have followed the story of badger/bTB over the past half-century, we have seen that these shifts have often directly determined policy outcomes, particularly relating to changing definitions of ‘humaneness’—and whether these are considered to be important—in and outside of policy. The contrast between 1980s decisions (to rapidly withdraw badger gassing using Cymag following new scientific findings suggesting it was cruel and ineffective) and 2010s decisions (to elide and avoid similar findings about ‘controlled shooting’) is particularly stark.

Following the election of the Coalition government in 2010 and its decision to reinstate badger culling as a bTB control policy, badger/bTB has shifted into a pattern of partisan alignment of for/against culling with party-political positions of right and left. While the reasons for the public polarisation of the controversy have been explored in depth in Chap. 7, a key driver appears to have been widening differences in the politics of care, and particularly the public performance of this care, via mass media coverage and other ‘public’ statements. As we have seen, the longer history of badger/bTB has seen an overall change in policy strategy, from an inclusive

mode which sought to involve all interests and keep important conversations ‘backstage’; to one which has pushed many actors out towards the ‘frontstage’ of the wider public sphere.<sup>26</sup> This appears to have happened through a combination of design (e.g. going from an inclusive Consultative Panel to an exclusive Advisory Group) and accident (e.g. scrapping a long-term, citizen-led ‘Badger Survey’ on cost grounds): the outcome has been an erosion of opportunities for the full range of actors most involved in the problem to talk directly with each other about it.<sup>27</sup> This highlights the importance of care—in domains as diverse as science, medicine, farming, animal health, conservation, policy, politics, animal welfare and animal rights—not only for bringing people, animals and environments together, but also for driving conflict. The literature on care in science and medicine has demonstrated how care and caring practices enable shared work, new knowledge, collaborations, alliances and entanglements.<sup>28</sup> Similarly, scholarship on violent or enforced practices of care (including hunting, culling, euthanasia, surgery and quarantine) has tended to focus on processes of shared meaning-making and mutual support.<sup>29</sup> The badger/bTB case highlights how the creation of intense shared ‘cultures of care’ *within* social groupings can drive a corresponding intensity of opposition *between* them. If people think of themselves as heroes (who really care), does it become easier to think of those who oppose them as villains (who really don’t)? Thinking through care as an aspect of conflict has great potential for helping us understand the drivers, propagators and eventual closure of knowledge controversies, and may also offer important insights into wider processes of political polarisation.<sup>30</sup>

## 8.4 EXPECTATIONS

Since tuberculous badgers were first found by government veterinarians in the early 1970s, the exemplary ‘policy failure’ of badgers and bTB has now been the responsibility of nine prime ministers, fifteen government administrations and twenty-one cabinet ministers.<sup>31</sup> The 2018 bTB Strategy Review is the ninth government-commissioned, expert-led report on bTB in the UK since Lord Solly Zuckerman’s in 1980.<sup>32</sup> Many of these reviews have been commissioned by politicians on the *expectation* that the views of authoritative experts and/or new scientific evidence will act to resolve the political controversies around bTB control. However, often the opposite has happened, whereby reviews have been criticised as a biased ‘whitewash’ (Zuckerman); or a ‘betrayal’ in which ‘the science’



invested in by government turned out to produce unexpected, uncertain and unwelcome findings (Krebs/ISG). In the meantime, further scientific research has revealed the deep complexity of the badger/bTB problem, finding new questions as much as it has provided answers. Often the outcome has been to drive media coverage of the problem, opening the issue up to wider public debate but also inflaming controversy. In the longer term, the repeated building and breaking of expectations between scientists, policymakers, politicians, campaigners and publics has contributed to an atmosphere of mistrust and the politicisation of ‘evidence’ both in and beyond the badger/bTB debate.<sup>33</sup> While this is in part symptomatic of wider problems in British policymaking, relating to expectation building/breaking, high turnover of civil servants and a wider lack of institutional memory, policy learning in badger/bTB has been further limited by rivalries within government between the animal health and disease ecology epistemic communities.<sup>34</sup>

As well as the mutual expectations that science can provide ‘all the answers’ and that politicians and policymakers will listen to what scientists say, this book has documented several other, equally corrosive expectation cycles in badger/bTB. We have seen repeated rounds of built and broken expectations about organisms, animals and environments—that they will be passive and amenable to policy decisions. Instead, the badger/bTB case has demonstrated how non-human actors play active roles in shaping history, policy and politics. This can be seen in the long-term consequences of the 2001 foot and mouth disease (FMD) outbreak for the spread of bTB, for the science of the RBCT and for relationships between farmers and government. The most dramatic example of this is the idea of badger ‘perturbation’—the awkward refusal of these animals to stay out of places we try and exclude them from. Even though specialists have known about the problem of ‘badger movement’ or ‘recolonisation’ since long before bTB entered the picture, whenever badgers exert their agency in this way, such events are greeted with surprise, shock and a continued refusal to anticipate that it will happen again. The badgers have indeed, repeatedly, moved the goalposts.<sup>35</sup> There have been similarly shared assumptions that people are not part of the badger/bTB problem—that this is entirely a phenomenon of the natural world. When research assumes that the densely lived-in landscapes of the South West of England can be controlled as easily as a laboratory, or policy assumes that culling livestock or wildlife has no implications for the people living alongside these animals, it then struggles to adapt when this turns out not to be so. Finally, there have been some peculiarly contradictory

assumptions about publics—those directly concerned with badger/bTB, as well as wider audiences and voters.<sup>36</sup> On the one hand, ‘lay’ actors such as farmers, naturalists and badger advocates (also instrumental members of epistemic communities) have been assumed to passively accept policy decisions, and that they have no useful knowledge to contribute. When land-owners have refused access, farmers insisted on ‘taking care’ of sick badgers themselves, naturalists have reported problems with gassing, and badger advocates have sabotaged culls in the field, policy has reacted with surprise and hostility, describing such actions as ‘interference’. At the same time, and sometimes in the same documents, ‘the public’ has been widely assumed to be universally anti-cull, by actors on all sides of the controversy.

Even now, we still don’t know that much about the opinions of the British population about badger/bTB: research conducted to date suggests that public attitudes vary according to demographic factors such as gender and regional location, and are highly contingent on culling having a more dramatic effect on bTB than it appears to.<sup>37</sup> We do know that when people are given the time, space and opportunity to engage with the complexities of bTB policy, their views tend to be more nuanced and productive than the YES!/NO! media debate over culling.<sup>38</sup> In line with other research on science and its publics, I think it is rhetorically useful for many involved in the badger/bTB debate to instead focus upon an ‘imagined public’, who can be strategically deployed to support arguments for or against culling, as well as to invoke a sense of marginalisation against which countervailing views can be justified.<sup>39</sup> These tactics feed into a wider tendency towards what I would describe as the politics of distraction—so culling is used to distract from the wider problems underlying badger/bTB, such as scientific complexity and uncertainty, the problems of testing, government cost-sharing agendas and the difficulties of living alongside awkward animals like badgers. In turn, bTB has provided a useful distraction away from a plethora of other political problems, as exemplified in Fig. 8.1. In 2011, these were a scandal over media ‘hacking’ of private citizens, the European debt crisis (and perhaps looming Russian influence?); in 2013 it may have been the internal tensions of the Coalition and Conservative Party; in 2019 we are constantly distracted by the political theatre of Trump, the Brexiteers and their political opponents. In all these cases, such tactics pull public and media attention towards heated, unproductive controversies and away from ‘backstage’ negotiation, engagement, compromise and building substantive, sustainable policy and political solutions for the long term.<sup>40</sup>



Fig. 8.1 David Cameron and the politics of distraction (Cartoon by Christian Adams, *Daily Telegraph*, 21 July 2011, 20. © Telegraph Media Group Limited 2011)

## 8.5 SOME QUESTIONS AND SUGGESTIONS

At the beginning of this book, I said that this work has only scratched the surface of what we need to know about the history of badger/bTB in Britain. I stand by that view—like all research, this work has uncovered many more questions which bear further investigation. To start with, what would the history of badger/bTB look like viewed from outside the central perspectives of government archives and national media? Social, natural and historical research on bTB is increasingly highlighting stark differences in experiences of badger/bTB across the various countries and regions of the UK, as well as the need to think at multiple scales about the problem.<sup>41</sup> Therefore a key priority would be to use local, community and oral history approaches to investigate how the controversy since the 1970s was experienced by farmers, naturalists, activists and other publics living in places affected (and unaffected) by badger/bTB. While the unique history of the badger/bTB situation in Northern Ireland has been investigated, the critical experiences of people in the South West of England have yet to

be documented.<sup>42</sup> Given that social research on bTB also points towards disjuncts in communication, engagement, responsibility, power and trust between central government and local actors as a key problem for bTB policy, the need to understand such histories is even more urgent. My work has also uncovered a further gap in the historiography of bTB—while late nineteenth- and early twentieth-century debates have been extensively investigated, and this volume traces the situation since the mid-1960s, we still have a rather sketchy understanding of how the disease was (mostly) brought under control in the post-war period. Other potentially fruitful areas of investigation include a comprehensive exploration of the shared histories of human and animal TB; more extensive research asking what wider publics in multiple places think about culling, animal health and the politics of wildlife in contemporary Britain; and the importance of care as a driver of knowledge controversies. I will end with some suggestions for policymakers, politicians, campaigners and anyone else involved with this messy and exhausting knowledge controversy. I build upon thoughts submitted to the 2018 Godfray Review on what I think the history of badger/bTB can tell us about where we might go next.<sup>43</sup> However, these cannot become properly useful or use-able policy recommendations without the input of those involved, and therefore I invite their thoughts.

*Looking, Seeing, Knowing and Acting on TB in Humans and Other Animals.* As outlined above, if bTB is being reframed as an environmental disease, this has deep epistemic implications—if what we know about badgers, cattle and *M. bovis* has been shaped by the technologies we use, where we decide to look, the presence of other microbes and environmental changes, and what we do with infected bodies, then both research and policy need to take account of this. Such insights can create more productive ways of understanding contradictory interpretations of ‘the science’ of bTB in relation to culling. For example, the Thornbury and other clearance trials of the 1970s are often held up as evidence that culling ‘works’, while the RBCT is used to support arguments that it doesn’t. However, in my view both these approaches—as well as the early experiences of ICD officers trying to get rid of troublesome badgers—may in fact be telling us similar things. It looks like badgers can be culled, and if this is done thoroughly enough, for long enough, over a wide enough area, there appear to be positive effects on bTB incidence in cattle. However, that’s a very big ‘if’—as this history has shown, it takes a great deal of time, money, effort and systematic organisation to get rid of badgers and keep them

away. Because *M. bovis* seems to pass between badgers–cattle, and between cattle–cattle, and (if newer research findings hold up) between these species and their environments, short-term, reactive, small-scale and ad hoc culling will risk disturbing local ecosystems and spreading the microbe further.<sup>44</sup> So the questions to ask of any bTB control measure would be: will this be this systematic enough? How do we determine this? How much effort and cost would be required to do the job properly? How big an effect can we expect, and once we know this, *is it really worth it*—ecologically, financially, politically and ethically? For many years, underlying policy agendas have advanced cost-sharing, decentralisation and reducing government oversight (particularly of culling), raising questions about the ability of government to systematically implement disease control. Given that historical research on how bTB risks were successfully managed in the first place points towards the importance of the state in coordinating and enforcing control measures, movement in the opposite direction does not bode well.<sup>45</sup> Thinking of bTB as an environmental disease also has wider implications for animal and human health policy. For example, if *M. bovis* and other mycobacteria can survive for longer outside the body, can *M. tuberculosis*? What would be the implications for global health? This cuts the other way: given that TB in humans has long been thought of as the ‘social disease’, then the social aspects of bTB should be taken much more seriously—not only as a political problem, but as a fundamental aspect of the disease.

*Wildlife Conflicts and Care.* Given that we can trace the British badger debate back to the Victorian era at least, and potentially as far as the Anglo-Saxons, the deep historical roots of this wildlife conflict also need to be taken seriously. Badger–human conflict (and human conflict about badgers) is deeply entangled with the bTB problem in this country. Therefore any sustainable bTB policy must also address those factors which make it difficult for badgers and people to co-exist, including their tendency to exercise their own agency, and the feelings this creates in people when for example their crops or other property gets damaged.<sup>46</sup> Practical frameworks for addressing these kinds of problems already exist, but have mostly been directed towards charismatic and rare species such as elephants, great apes and big cats, often in the Global South.<sup>47</sup> If we in Britain expect people elsewhere to live with (and care for) much more difficult and dangerous charismatic species, should we not learn to cope with one mildly cantankerous mustelid? Other historically awkward animals, including beavers, wild boar and polecats, are now returning to the British

countryside: for them to flourish we need to find modes of co-existence which can take account of animal agency and benefit all publics, not just those who already care deeply for wildlife.<sup>48</sup> I noted at the end of Chap. 6 that there seems to be some ‘backstage’ potential for moving past the unproductive and bruising confrontations of today’s public controversy. For this to happen, wider recognition is needed that all those involved do care a great deal—but what they care about and for may be different. We already know that, given time, space, in-depth information and opportunities for personal connection, people can engage with the deep complexities—and conflicting values—of this problem. Ultimately it is in the interests of those most involved and affected to work together and explore the ‘diplomatic spaces’ where there is potential for common ground. However, such processes need proper financial, institutional and practical support.<sup>49</sup>

*Science, Policy and Expectations.* The repetitive and unproductive cycle of building and breaking expectations seen over the past forty years or so suggests that some serious rethinking of UK science–policy relations—in and beyond animal health—is long overdue. Many people involved in the problem are already trying to do this, but my contributions follow. First, I would suggest that rather than calling for reviews at politically strategic moments, government should instead review this kind of complex and changing evidence base on a regular basis, with clearly established routes for research and policy activity to feed into one another, and for practical outcomes. What counts as ‘evidence’ needs to be broadened to include work from multiple STEM disciplines; quantitative and qualitative social science; humanities scholarship; the experiential expertise of professionals and volunteers closely involved with the situation; and should transparently take account of the contrasting and conflicting views of multiple publics. This could help politicians and policymakers to take a broader view of the situation and have a clearer understanding of the strategic redefinition and elision of evidence by campaigners on all sides—as well as what we *do not* know and perhaps *cannot* do.<sup>50</sup> As outlined above, there is strong potential for new technological developments—particularly in testing and possibly in vaccination—to create new possibilities for bTB policy. I believe that such potential should absolutely be explored, whilst also *anticipating* that they may not succeed, or if they do, will bring about new uncertainties and regulatory challenges. Technological solutions are indeed possible: the trap is to believe that the quick, easy, just-about-to-happen in five years technological fix means that nothing else needs to be

done.<sup>51</sup> While I agree that the role of ‘ministerial judgement’ is essential and should be transparently acknowledged in badger/bTB, to cede all policy influence to elected politicians strikes me as a potential recipe for further manipulation of expertise and public polarisation.<sup>52</sup>

Instead, I suggest that properly supported mechanisms for regular, in-person interaction between the various interests concerned with bTB policy be reinstituted, at national and local level. While this seems to be happening sometimes, behind the scenes, the creation of policy ‘insiders’ and ‘outsiders’ has contributed to the political polarisation of bTB.<sup>53</sup> As I argued in Chaps. 6 and 7, since the 1990s this has been exacerbated by increasing disconnects between the backstage of bTB policy and the front-stage of public debates. To move forwards, government may need to return to older, more inclusive styles of policymaking, no matter which political party is in charge. Experiments with dialogue and participatory governance suggest that, paradoxically, explicitly setting aside the goal of consensus can help opponents understand each other’s points of view better and find ways of working together.<sup>54</sup> Finally, in line with the recommendations of other historians studying and working with policymakers, efforts to build more coherent institutional and public memories should be supported.<sup>55</sup> This would make it less likely that we keep revisiting past failures in bTB itself (such as gassing), but also more likely to draw wider lessons for applied research (such as the value of lab–field partnerships and independent regional expertise) and for science–policy relations (such as the dangers of unrealistic expectations). I believe that a more concerted effort to ‘do TB differently’<sup>56</sup> and properly re-examine the situation from all those involved would greatly benefit the back-, front- and centre-stage of British animal health, agricultural and environmental policies.

## NOTES

1. For accessible primers on the natural science of bTB (from several angles), I refer readers to (1) TB Knowledge Exchange, run by my Exeter colleague Dr Robertson, ‘TB Knowledge Exchange’; (2) the multi-agency-funded TB Hub: <http://www.tbhub.co.uk/> and TB Advisory Service: <http://www.tbas.org.uk/>; (3) the badger/bTB briefing pages of the British Veterinary Association: <https://www.bva.co.uk/News-campaigns-and-policy/Policy/Farm-animals/Bovine-tuberculosis/>; (4) a recent briefing from the Zoological Society of London ZSL, ‘Eradicating TB from Cattle and Badgers—A Review of Evidence’; and (5) the 2018 Godfray review of



- government bTB policy, Godfray et al., 'A Strategy for Achieving Bovine Tuberculosis Free Status for England'.
2. See also Brown and Michael, 'A Sociology of Expectations'; V. C. Broto, 'Environmental Conflicts, Research Projects and the Generation of Collective Expectations: A Case Study of a Land Regeneration Project in Tuzla, Bosnia and Herzegovina', *Public Understanding of Science* 21(4) (November 2010): 432–46; Michaela Maier et al., 'Communicating Scientific Evidence: Scientists', Journalists' and Audiences' Expectations and Evaluations Regarding the Representation of Scientific Uncertainty', *Communications* 41(3) (2016): 239–64; Brown and Beynon-Jones, 'Reflex Regulation'.
  3. See Sect. 1.3; also Rosenberg and Golden, *Framing Disease*.
  4. Woods et al., *Animals and the Shaping of Modern Medicine*, 1–26.
  5. See Sect. 3.1.
  6. See Sect. 4.2.
  7. See Sect. 6.4.
  8. See Sect. 3.4.
  9. Enticott, 'The Local Universality of Veterinary Expertise and the Geography of Animal Disease'.
  10. As does a supplementary blood test known as interferon-gamma.
  11. Sara H. Downs et al., 'Methodology and Preliminary Results of a Systematic Literature Review of Ante-Mortem and Post-Mortem Diagnostic Tests for Bovine Tuberculosis', *Preventive Veterinary Medicine* 153 (1 May 2018): 117–26.
  12. Andrea Sanchez-Hidalgo et al., 'Mycobacterium Bovis Hosted by Free-Living-Amoebae Permits Their Long-Term Persistence Survival Outside of Host Mammalian Cells and Remain Capable of Transmitting Disease to Mice', *Environmental Microbiology* 19(10) (October 2017): 4010–21; J. A. Barasona et al., 'Environmental Presence of Mycobacterium Tuberculosis Complex in Aggregation Points at the Wildlife/Livestock Interface', *Transboundary and Emerging Diseases* 64(4) (2 July 2017): 1148–58.
  13. WHO, 'WHO|Roadmap for Zoonotic Tuberculosis'.
  14. Bynum, *Spitting Blood*; Lukas Engelmann and Janina Kehr, 'Double Trouble: Towards an Epistemology of Co-Infection', *Medicine Anthropology Theory* 2(1) (2015): 1–31; McMillen, *Discovering Tuberculosis*.
  15. See Sect. 1.4.
  16. See Sect. 4.3.
  17. See Sect. 5.3; for making animals 'killable' see Haraway, *When Species Meet*, 77–82.
  18. See Sects. 7.2–7.4. For charismatic species see e.g. J. Lorimer, 'Nonhuman Charisma', *Environment and Planning D: Society and Space* 25 (2007): 911–32.



19. See Sect. 1.4, also e.g. Cassidy, 'Badger–Human Conflict'; Delahay et al., 'Managing Conflict between Humans and Wildlife'.
20. Enticott, 'Techniques of Neutralising Wildlife Crime in Rural England and Wales'; Phoenix, 'Local Understandings of Bovine Tuberculosis (Working Title)'.
21. E.g. Delahay et al., 'Managing Conflict between Humans and Wildlife'; Johanna Judge et al., 'Effectiveness of Biosecurity Measures in Preventing Badger Visits to Farm Buildings', ed. Justin David Brown, *PLoS ONE* 6(12) (December 2011): e28941–e28941.
22. See Sect. 1.2, also on epistemic communities, Meyer and Molyneux-Hodgson, 'Introduction'; Dunlop, 'Epistemic Communities'. For knowledge and cultures of care, see Davies et al., 'Science, Culture, and Care in Laboratory Animal Research'.
23. See Sects. 3.3, 4.4, and 5.4. For a broader perspective see also Agar, 'Transition'.
24. Conlan et al., 'The Intractable Challenge of Evaluating Cattle Vaccination as a Control for Bovine Tuberculosis'.
25. See Sects. 5.3–5.4; also e.g. Morris, 'Introduction'; Davies et al., 'Science, Culture, and Care in Laboratory Animal Research'; Druglitrø, "Skilled Care" and the Making of Good Science'.
26. See Chs. 5 and 6 for these themes, also Ayres, Sandford and Coombes, 'Policy-Making "Front" and "Back" Stage'; Hilgartner, *Science on Stage*.
27. Grant, 'Intractable Policy Failure: The Case of Bovine TB and Badgers'.
28. Davies et al., 'Science, Culture, and Care in Laboratory Animal Research'; Richard Gorman, 'Therapeutic Landscapes and Non-Human Animals: The Roles and Contested Positions of Animals within Care Farming Assemblages', *Social & Cultural Geography* 18(3) (May 2016): 315–35; A. Martin, N. Myers and A. Viseu, 'The Politics of Care in Technoscience', *Social Studies of Science* 45(5) (October 2015): 625–41.
29. Van Dooren, 'A Day with Crows'; Haraway, *When Species Meet*; Morris, 'Introduction'; Marvin and McHugh, 'In It Together'.
30. On the public polarisation of science and environmental issues, see Kahan et al., 'The Polarizing Impact of Science Literacy and Numeracy on Perceived Climate Change Risks'; M. C. Nisbet and E. M. Markowitz, 'Expertise in an Age of Polarization: Evaluating Scientists' Political Awareness and Communication Behaviors', *The ANNALS of the American Academy of Political and Social Science* 658(1) (2015): 136–54; Lucas and Warman, 'Disrupting Polarized Discourses'.
31. On policy failure in animal health see Claire A. Dunlop, 'Pathologies of Policy Learning: What Are They and How Do They Contribute to Policy Failure?' *Policy and Politics* 45(1) (January 2017): 19–37; Grant, 'Intractable Policy Failure'.
32. See Sects. 1.1 and 6.1. for further discussion of these expert reviews.

33. On expectations in science-policy see Brown and Beynon-Jones, 'Reflex Regulation'.
34. Bob Hudson, 'Why Policy Failure Is so Common in the UK', *LSE Business Review* (blog), 26 January 2019; Tom Sasse and Emma Norris, 'Moving On', 16 January 2019; Katy Wilkinson, 'Organised Chaos: An Interpretive Approach to Evidence-Based Policy Making in Defra', *Political Studies* 59(4) (December 2011): 959–77; Parker, 'The Rothschild Report (1971) and the Purpose of Government-Funded R&D'; Dunlop, 'Pathologies of Policy Learning'.
35. See Sects. 2.2–2.4, 4.3, and 6.2–6.4.
36. In line with most researchers working in this area, I think it is generally more realistic and useful to think about science–society relations in terms of multiple 'publics' rather than 'the public': Jason Chilvers and Matthew Kearnes, *Remaking Participation: Science, Environment and Emergent Publics* (New York: Routledge, 2015).
37. The most in-depth work to date exploring wider public attitudes to badger culling confines itself to Wales: see Enticott, 'Public Attitudes to Badger Culling to Control Bovine Tuberculosis in Rural Wales'.
38. OPM Group, 'Defra Bovine TB Citizen Dialogue'.
39. Claire Marris, 'The Construction of Imaginaries of the Public as a Threat to Synthetic Biology', *Science as Culture* 24(1) (2015): 83–98; J. Barnett et al., 'Imagined Publics and Engagement around Renewable Energy Technologies in the UK', *Public Understanding of Science* 21(1) (2012): 36–50; Bickerstaff, Simmons and Pidgeon, 'Situating Local Experience of Risk'.
40. Lester and Hutchins, 'The Power of the Unseen'; Maye et al., "'Present Realities" and the Need for a "Lived Experience" Perspective in Brexit Agri-Food Governance'; Jennings and Lodge, 'Brexit, the Tides and Canute'; Lodge and Matus, 'Science, Badgers, Politics'.
41. Enticott, 'Market Instruments, Biosecurity and Place-Based Understandings of Animal Disease'; Robinson, 'A History of Bovine Tuberculosis Eradication Policy in Northern Ireland'; Philip A. Robinson, 'Farmers and Bovine Tuberculosis: Contextualising Statutory Disease Control within Everyday Farming Lives', *Journal of Rural Studies* 55(Supplement) C (1 October 2017): 168–80; Maye, 'Geography Matters'.
42. Philip A. Robinson, 'A History of Bovine Tuberculosis Eradication Policy in Northern Ireland', *Epidemiology and Infection* 143(15) (2015): 3182–95.
43. Angela Cassidy, 'The UK's Bovine TB Strategy: A Prospective View from History', Submission to Defra, Bovine TB Strategy review 2018: call for evidence (Exeter: University of Exeter, 2018).

44. See also Prentice Jamie C. et al., 'When to Kill a Cull: Factors Affecting the Success of Culling Wildlife for Disease Control', *Journal of The Royal Society Interface* 16(152) (6 March 2019): 20180901.
45. Olmstead and Rhodes, *Arresting Contagion*; Atkins, *A History of Uncertainty*; Waddington, *The Bovine Scourge*.
46. Susan Boonman-Berson, Clemens Driessen and Esther Turnhout, 'Managing Wild Minds: From Control by Numbers to a Multinatural Approach in Wild Boar Management in the Veluwe, the Netherlands', *Transactions of the Institute of British Geographers* 44(2) (2019): 2–15.
47. Simon Pooley et al., 'An Interdisciplinary Review of Current and Future Approaches to Improving Human–Predator Relations', *Conservation Biology* 31(3) (2017): 513–23; Hill, 'Perspectives of "Conflict" at the Wildlife–Agriculture Boundary'.
48. Boonman-Berson, Driessen and Turnhout, 'Managing Wild Minds'; Sarah L. Crowley, Steve Hinchliffe and Robbie A McDonald, 'Nonhuman Citizens on Trial: The Ecological Politics of a Beaver Reintroduction', *Environment and Planning A* 49(8) (1 August 2017): 1846–66; Crowley, Hinchliffe and McDonald, 'Conflict in Invasive Species Management'.
49. Price et al., 'From Contradiction to Contrast in a Countryside Conflict'; Saunders and Keenan, 'Conflict Framing in the Control of Bovine Tuberculosis'; Sandover, Kinsley and Hinchliffe, 'A Very Public Cull'.
50. Christl A. Donnelly et al., 'Four Principles to Make Evidence Synthesis More Useful for Policy', *Nature* 558(7710) (June 2018): 361; Andy Stirling and Clive Mitchell, 'Evaluate Power and Bias in Synthesizing Evidence for Policy', *Nature* 563 (5 September 2018): 33.
51. Lisa Rosner, *The Technological Fix: How People Use Technology to Create and Solve Problems* (New York: Routledge, 2013).
52. See Godfray et al., 'A Strategy for Achieving Bovine Tuberculosis Free Status for England', 2, 107–8; Boyd, 'Making Science Count in Government'.
53. See Sects. 5.4 and 7.3.
54. Warren Pearce et al., 'Beyond Counting Climate Consensus', *Environmental Communication* 11(6) (23 July 2017): 723–30; K. M. Centellas, R. E. Smardon and S. Fifield, 'Calibrating Translational Cancer Research: Collaboration without Consensus in Interdisciplinary Laboratory Meetings', *Science, Technology & Human Values* 39(3) (October 2013): 311–35.
55. For excellent practical examples, see the work of *History & Policy* (<http://www.historyandpolicy.org/>) and e.g. Virginia Berridge, 'Thinking in Time: Does Health Policy Need History as Evidence?' *The Lancet* 375(9717) (2010): 798–99; Abigail Woods, 'The Lowe Report and Its Echoes from History', *The Veterinary Record* 169(17) (October 2011):

- 434–36; Pat Thane, *Unequal Britain: Equalities in Britain since 1945* (London: Bloomsbury Publishing, 2010); Hugh Pemberton, ‘Policy Networks and Policy Learning UK Economic Policy in the 1960s and 1970s’, *Public Administration* 78(4) (1 January 2000): 771–92.
56. Price et al., ‘From Contradiction to Contrast in a Countryside Conflict’.

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