

One Health: competing perspectives in an emerging field

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(Received 5 October 2015; revised 1 December 2015; accepted 2 December 2015; first published online 28 January 2016)

SUMMARY

Over the last decade, One Health has attracted considerable attention from researchers and policymakers. The concept argues that the fields of human, animal and environmental health ought to be more closely integrated. Amid a flurry of conferences, projects and publications, there has been substantial debate over what exactly One Health is and should be. This review summarizes the main trends in this emerging discussion, highlighting the fault lines between different perspectives on One Health. Some have shown that One Health's call to synthesize knowledge from different disciplines can lead to better interventions. Others, however, argue that One Health's challenge to existing practice must go further, and set out a vision that foregrounds the social and economic drivers of disease. Meanwhile, recent examples of One Health in practice highlight the potential but also the challenges of institutionalizing cooperation. We also discuss the promise and pitfalls of using complexity theory to tackle multifaceted problems, and consider how the One Health concept has been brought to bear on other issues, such as emerging new technologies. Ultimately, One Health is an important and worthwhile goal, and requires a debate that clarifies both the competing uses and the political nature of the project.

Key words: One Health, One World – One Health, zoonoses, policy, social science.

INTRODUCTION

Over the last decade or so, One Health has attracted considerable attention from researchers and policymakers. Described variously as a methodology, approach, strategy, concept and a movement, the essential One Health argument is that the fields of human, veterinary and environmental health should be more closely integrated. As Bresalier *et al.* (2015) have established, demand for this sort of collaboration is not itself new, but has gained particular momentum since the outbreak of Avian Influenza in 2004. It is this modern era of One Health that we focus on in this review.

As Gibbs (2014) points out, there has been a remarkable range of One Health activities initiated during this short period of time: major new research projects, institutional collaborations of various kinds, the establishment of new training courses and MSc programmes, along with a panoply of policy papers, conferences and academic publications. This rapid proliferation of activities begs several important questions, which this review sets out to explore. Namely: in what ways have different scholars conceived of One Health, and what are the implications of these competing frameworks? Is One Health simply a convenient relabeling of existing activities, or a more radical critique of the ways in which science and health professionals work? What lessons can be learnt from recent attempts to

institutionalize One Health, and what complications are One Health research and practice likely to face in the future? Such questions are of particular significance for parasitologists, not least because of the importance and the sheer number of zoonotic parasites (Kaplan *et al.* 2009). One Health is also a framework through which parasitological knowledge can inform debates over research priority setting (Robertson *et al.* 2014) and complex problems such as parasites in wildlife (e.g. Thompson, 2013; Jenkins *et al.* 2015).

This paper summarizes recent trends in One Health scholarship, with particular attention to an emerging body of social science and policy literature which explores exactly what One Health is and should be about. Such scholars have pursued a number of lines of enquiry. Most directly, a number of researchers have considered how One Health can enhance health practice. Some have shown that One Health can mean responding to health problems in ways that are much more closely informed by social science, building on a tradition of applied medical sociology and anthropology. Drawing from those same disciplines, another thread of scholarship has rather different ambitions: these authors use the wide-angled perspective of One Health to draw attention to unhelpfully narrow aspects of the current system of global health. Specifically, they emphasize that a global health system focuses on biosecurity and infection control risks, ignoring the larger scale political, economic and biological processes that create the conditions for disease. In this way, these studies mark out

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a series of aspirations for what One Health might be able to accomplish. A key fault line in these studies is their orientation towards global health – should current global health strategies be supported or reformed? Or, more radically, should global health policy expand beyond a sole focus on the welfare of humans?

A somewhat separate group of studies is concerned not with aspirations, but with the concrete ways in which One Health projects have been carried out. These studies emphasize how the goals of collaboration and coordination are a good deal easier said than done. Professional competition, conflicting priorities, institutional inertia and myriad other factors in diverse contexts make the implementation of One Health projects a major undertaking. Similarly, complexity theory offers researchers a compelling means of integrating different kinds of variables together in a single analytical framework, but is an approach that is fraught with challenging conceptual questions. Whilst the topics outlined above are the central discussions in the emerging social science of One Health, a number of other authors, often with more theoretical papers, have tried to extend the One Health concept into less familiar territory. A number of papers on new technologies such as transgenic animals and edible insects seek not just to patrol the pathogenic borders between humans, animals, vectors and the environment, but to show how those borders are being redefined. Lastly, a small body of scholarship makes the case that a number of other issues that have been thus far marginal to this intellectual project should now be brought under the One Health umbrella: for instance, human and animal companionship, and animal welfare.

In short, while the last decade has seen the One Health concept established as well-known shorthand for a range of connected issues, as an intellectual project it has become somewhat fragmented. Different actors from diverse backgrounds and disciplines are using the concept to advance very different perspectives and agendas. We do not see this diversity of viewpoints as a blemish or fatal weakness for One Health; instead we aim to provide some clarity and synthesis to what has become an extremely wide-ranging debate. This clarity, we believe, is essential to fostering a productive discussion about what is required to turn One Health from an attractive but vague rubric into a truly compelling approach which donors, governments and research institutions will take up as matter of course because they are convinced of its added value, both financially and conceptually (Rushton *et al.* 2012; Zinsstag *et al.* 2012). That this debate encompasses so many divergent perspectives is itself a reflection on the challenge the One Health agenda faces: working together across disciplines and professions is rarely straightforward; for collaboration to be bountiful, careful consideration of different

views, which we hope to provide below, will be essential.

METHODS

This paper does not aim to provide a comprehensive or systematic bibliography of One Health (for an example of such an approach, see Valeix, 2014), but rather a selective, critical review which focuses strategically on key debates. In addition to searching Google Scholar for ‘One Health’, ‘One World One Health’ and related terms (with a particular focus on material published since 2000), we were guided by the agendas of various recent conferences and workshops, which set out the current debates in One Health. We focussed on those publications which reflected on the One Health concept itself, and the broader issues with which it is entangled, as opposed to purely technical or scientific studies which happen to invoke the term.

ONE HEALTH IN HISTORY

We begin this review with a brief comment on the historical origins of the One Health.

Many have argued that the current enthusiasm for One Health follows in a longer tradition of collaboration between different professions. While this is true to an extent, as Bresalier, Cassidy and Woods (2015, 1) point out, such accounts – which tend to highlight the roles of heroic individuals and scientific breakthroughs – ‘are neither politically neutral nor historically well-grounded’. Instead, they have often ‘been assembled not for the purpose of understanding the past but for advancing the case for One Health today’. Woods and Bresalier (2014) suggest that the real background story to One Health is much more complicated, encompassing *many histories* and not a single linear narrative. In their retelling, collaboration between the disciplines has ebbed and flowed over the years, at different times, and in different settings for a number of political, institutional and epistemological reasons yet to be fully understood. Thus while examples of interconnectedness between the human and animal health spheres can be traced back to ancient Greece, the uncritical and retrospective application of a One Health framing to historical events and figures should be cautioned against if, like Bresalier *et al.* (2015, 10) we understand One Health as ‘self-consciously labelled set of activities and agendas’ which have coalesced only recently out of a complex and dynamic set of relationships.

While the history of One Health (and its direct forefathers ‘comparative medicine’, ‘one medicine’ and ‘ecohealth’) continue to be debated, important areas of neglect can be identified. Bresalier *et al.* (2015) highlight the neglected history of One Health in non-Western contexts, a point we wish to expand given our own interest in African

trypanosomiasis. Much useful history has been written on the colonial history of African trypanosomiasis by historians such as Brown (2008); Tilley (2011) and Neill (2012), whose detailed accounts could easily be added to the One Health genre. These histories emphasize how colonial efforts to control the disease in humans and animals led to a gradual broadening of focus outward from the disease subject, to include the disease vector (the tsetse fly), and ultimately its environment; thus supporting Robins (1997) notion that ecology was a ‘science of empire’ that the colonial powers patronized to allow them to exploit their new environment. This strong tradition of tackling the environmental drivers of disease features key figures and institutions that today might be rebranded champions of the One Health cause. For example, Assistant Secretary of State William Ormsby Gore while addressing the 1928 International Sleeping Sickness Conference argued that ‘it is absolutely essential that both the medical and veterinary problems should be discussed in their widest ecological bearings’ (Tilley, 2011, 177); whilst Charles Swynnerton, a British field officer in Tanganyika, pursued cooperation across scientific disciplines and went on to establish the Tsetse Research Department, a body which actualized his multi-dimensional approach to trypanosomiasis control.

However, across these narratives, it is the fly and its ecology that remains the common denominator for collaboration across the disciplines, whether it’s Tilley and Neill recounting efforts to tackle the human forms of the disease, or Brown explaining how the livestock form of the disease ‘nagana’ was tackled in South Africa. Far more rare are African case studies of health and veterinary collaboration, even around the zoonotic form of African trypanosomiasis, *Trypanosoma brucei rhodesiense*. If we are to understand more clearly why some of the precursors to One Health flourished whilst others struggled to find purchase, both new research, particularly on previously neglected topics such as local/traditional histories of disease control (Brown, 2014), and syntheses of existing veterinary and human health histories will be essential.

ONE HEALTH – THE KEY DEBATES

Various arguments have been advanced for the value of One Health in its modern form. This section deals, in turn, with attempts to use the concept of One Health to make research and policy better informed, fairer and finally, more open to dynamic, complex forms of analysis. We also review some recent examples of attempts to institutionalize the One Health concept in formal organisational structures.

A better informed approach to global health

One important thread of scholarship has used the interdisciplinary nature of One Health to champion

health interventions that are grounded in a wide range of knowledge, and do not rely on a set of purely medical assumptions. For instance, Giles-Vernick *et al.* (2015) use a wide range of qualitative evidence to trace the complex connections between local and biomedical understandings of Buruli ulcer in Cameroon. Other similar work has asserted the importance of using a combination of social scientific and technical approaches to build a more comprehensive knowledge base to tackle, for example, anthrax (Coffin *et al.* 2015), brucellosis (Godfroid *et al.* 2013) and livestock ticks (Walker, 2011). Bardosh *et al.* (2014) make a similar case regarding the control of neglected helminths in Laos – though they also warn of the difficulties of reconciling large scale projects with multiple complex local environments. In a sense, these studies leverage the recent enthusiasm for One Health to advance an argument of much longer standing: interventions that focus technical and medical activities are often insufficiently adapted to the contexts in which they work.

If such scholarship is primarily focussed on either critiquing or improving specific types of health intervention, others raise related issues at a systemic level. For instance, Hinchliffe (2015) shares the concerns of Bardosh *et al.* regarding the difficulties global health agendas are likely to have in adapting to different contexts, but goes further, suggesting that the ‘One World – One Health’ formulation itself is particularly prone to collapsing local diversity into unhelpful ‘one-size-fits-all’ global policy making (see similarly, Okello *et al.* 2014) (‘One World – One Health’ is, as Galaz *et al.* (2015, 3) point out, a slogan copyrighted by the World Conservation Society. Although it is largely used synonymously with ‘One Health’, it is sometimes used to emphasize the global nature of the agenda). Relatedly, Okello *et al.* (2015) point out that the means by which health policy is made in developing countries is often poorly understood, suggesting that a truly comprehensive One Health approach will also need to include knowledge of these processes.

A fairer approach to global health

We turn now to a group of arguments that use the One Health concept not merely to make interventions smarter, but to address a set of political and ethical issues within the global health agenda. A central issue, again raised by Hinchliffe, is One Health’s tendency (at least as currently practiced) to concentrate on controlling disease at the point of transmission. As Galaz *et al.* (2015); following Wald, (2007) argue, a considerable proportion of One Health work has emphasized an ‘outbreak narrative’ that focuses on the risks posed by zoonotic infections, and the surveillance tools necessary to detect and contain them. Implicit in this worldview

is a threat posed to Western countries from perceived ‘hotspots’ elsewhere. Thus the supposedly universal ‘One World’ perspective can privilege a scientific and Western-centric concern with pathogenic contamination. In this view, the structural drivers of human and animal disease are too often marginalized. Seeking to rebalance the debate, Mutsaers (2015, 130) has suggested that One Health should stress ‘not only...how easily life is threatened, but also...our dependence upon others, of co-existence as a basis for our existence, biologically as well as politically’, a reading of One Health that may be useful in building approaches that emphasize solidarity and partnership over defensive, self-interested biosecurity.

If One Health risks furthering an excessively narrow approach that focuses on defending against particular zoonotic threats, then what are the broader alternatives? One alternate vision is outlined by Wallace *et al.* (2015) in their call for a ‘structural One Health’ – in this perspective, the traditional division between human and veterinary medicine is merely one of several boundaries that must be dismantled. It is of equal importance, they argue, for health to be understood in terms of political economy, giving primacy to poverty, inequality and the interests of capital as drivers of disease. This is necessary not just to make interventions better, as discussed above, but to redirect attention towards underlying political and economic issues. For instance, there is a call to address the ways in which social deprivation and multiple diseases form mutually reinforcing ‘syndemics’ (see Rock *et al.* 2009, following Singer, 1994). In this analysis, the task of One Health is to critically discuss socio-economic processes such as livestock intensification, acute inequality and the destruction of various natural habitats that have the potential to destabilize ecosystems and make pathogenic transmission and other sources of disease more likely. In other words, a structural One Health is one that not merely seeks to make, say, global livestock value chains more biosecure, but also asks fundamental questions of the livestock industry itself. This can only be done through broader kinds of research. For instance, Liverani *et al.* (2013) show how industrialized animal production provides opportunities to protect against many diseases, whilst simultaneously introducing new pathogenic risks. Yet this is merely one of several complex trade-offs involved, as a truly structural One Health must also consider the significance of livestock intensification on food security, healthy diets in humans, climate change, the ‘winners and losers’ in animal production value chains and so on.

This call to focus attention on the structural and social processes that drive disease is closely related to the tradition of livelihoods studies and theory, a perspective in development studies that has long argued for the integrated study of social and environmental

processes (originally Sen, 1981 and Chambers and Conway, 1992, see Scoones, 2009 for a more recent critical discussion). Indeed, it should be of little surprise that One Health has provided a welcome means to continue aspects of livelihoods research that have historically emphasized human, animal and interfaces, such as research on pastoralist communities (Greter *et al.* 2014). Whilst livelihoods theory has produced much useful and challenging work, scholars working to develop a similar body of One Health evidence will need to confront much of the same difficulties faced by this sub-discipline. Namely, that holistic studies which emphasize connectedness and the multiplicity of interrelated factors can cause complications and confusion when putting research into practice. Furthermore, as Morse *et al.* (2009) warn, as valuable as livelihoods (or, by extension One Health) research is, it can be both difficult and expensive to conduct, and produce analyses that are not always readily comparable.

A global health that is adaptable to complexity

As researchers and policy makers are encouraged to take a broader view of the causes of ill-health, increasingly sophisticated analytical frameworks are required. The problem, it is argued, is that an over-reliance on biomedical knowledge leads to a:

simplicistic view of pathogens...disconnected from a social and ecological context...[that] assumes a linear response of pathogens to environmental change. (Wilcox and Colwell, 2005, 244)

Thus, what is required is more than simply making use of a wider range of methods and evidence, but innovations in interpretation and prediction that make use of non-linear forms of analysis. This interest in complexity – an approach that emphasizes the importance of unpredictability and non-linear relationships – closely parallels an emerging debate in development studies, where the critique of existing analysis is very similar:

There is in foreign aid a widespread bias towards seeing interconnected, dynamic and open problems as simple, closed problems that can be planned for, controlled, and measured. (Ramalingam, 2013, 13)

Indeed, for Ramalingam (2013, 337) interpreting epidemiological data is a key example of linear and non-linear forms of analysis. Taking the example of epidemiological statistics in Niger, he explains how ‘aggregate annual measures of measles cases hide the dynamic complexity of the disease,’ noting that apparently random outbreaks can be related to seasonal migration patterns and the inconsistent deployment of vaccinations. According to Ramalingam:

These findings offer a cautionary lesson against making assumptions that diseases always follow a

predictable pattern...the heart of the problem was the limit that non-linearity places on the ability of public health interventions to project into the future: one runs the risk of either overestimating failure or overestimating success. “The goal is to “come up with strategies and interventions that are robust in the face of underlying uncertainties”” (ibid: 338, quoting Ferrari *et al.* 2008)

Given the nature of One Health problems, there is a particular need for research which is open-ended – problems like Avian flu require researchers to explore ‘multidimensional data space over which viral genetics, locales, and the socioecological matrix are related, rather than out of a strict set of a priori (and ultimately arbitrary) categories’ (Wallace *et al.* 2015, 7).

Whilst there are welcome examples of this kind of analysis, those same studies also demonstrate the difficulties involved in using complexity-centric approaches to policy and practice. The relationship between climate change and One Health is a pertinent issue – the climate is after all a paradigmatic example of complexity, with its feedback loops, risk and uncertainty (Shackley and Wynne, 1996; Lemos and Rood, 2010). One common concern is that research that emphasizes the limits to knowledge and the unpredictability of the future will, like the ‘information overload’ sometimes associated with livelihoods research, lead to a form of policy paralysis:

The complexity and uncertainty associated with global climate change and its effect on disease incidence and distribution have proven challenging from both the research and policy standpoints. As a public health issue this can, unfortunately, be misconstrued as suggesting a lack of consensus among experts that the potential human health consequences—though as yet not clearly demonstrated—are of significant concern. (Wilcox and Colwell 2005, 252)

Given the potentially transformative benefits of integrated, dynamic modes of analysis, grappling with complexity will be a key task for One Health advocates in future. The challenge will come in reconciling the inherent difficulty in predicting multifaceted phenomena with the ‘political pressures to be seen to be in control in a world of uncertainty and surprise’ (Eyben, 2013, 3).

Institutionalizing a One Health approach

One Health is not merely an aspirational research agenda – a number of scholars have explored the attempts of existing institutions to formally enact a One Health approach.

Chien (2013) notes that following the outbreak of avian influenza in 2003, the World Health

Organization (WHO), the Food and Agricultural Organization (FAO) and the World Organization for Animal Health (OIE) initially found themselves competing for legitimacy and funding when they drew on competing frames (‘technical/biomedical’, ‘societal intervention’ and ‘ecological conservation’) to prescribe solutions for the outbreak. In recognition that a lack of cooperation was actively hampering the global response, over a 5-year period the agencies moved to collaborate, and in 2008 endorsed the One World – One Health Framework. Chien emphasizes the ‘vagueness’ of the One World – One Health Framework they adopted, suggesting that it is this quality which allowed the three agencies to merge their competing frames, while also reducing conflict, avoiding criticism and creating a global consensus to facilitate coordination.

Smith *et al.* (2015) highlight several challenges to the state enacting a One Health approach to tackle trypanosomiasis in Uganda. In 1992, the Ugandan government passed an Act of Parliament establishing the Coordinating Office for the Control of Trypanosomiasis in Uganda (COCTU), a One Health-style platform tasked with coordinating the response of all involved government departments, donors, researchers and non-governmental organizations active in trypanosomiasis in the country. Yet Smith, Taylor and Kingsley note how at times external actors have circumvented COCTU’s authority by attaching an ‘emergency’ framing to their interventions; moreover, how an elimination target set at the global level has undermined the country’s agency to determine its own plan for trypanosomiasis, despite conferring no extra funding for control. Both challenges to COCTU’s remit speak to the difficulty of exerting authority over external actors and events in the context of aid dependency. A third challenge to COCTU’s remit is identified internally; in short, Uganda’s policy of decentralization, which has devolved the budget for tsetse and trypanosomiasis control to the districts, has proved detrimental for controlling the disease.

Finally, Mwacalimba and Green (2015) note that while the One World, One Health concept facilitated intersectoral partnerships for avian influenza preparedness in Zambia, certain ‘policy narratives’ (Scoones and Foster, 2010) found more traction than others, with a narrow focus on infectious disease acting to marginalize trade and development concerns. This limited the effectiveness of a trade ban on poultry, in addition to the longer-term sustainability of any multi-sectoral disease control strategy.

Other research considers the factors that might enhance or inhibit One Health activities across institutional boundaries. Kayunze *et al.* (2014) report on the ‘bridges’ (contributing factors) and ‘barriers’ (impeding factors) to inter-sectoral collaboration between human, animal and wildlife experts in

Tanzania. The main bridges were instruction by high level leaders, zoonotic diseases of serious impact and funding; the main barriers were lack of knowledge about animal or human health issues, lack of networks for collaboration and lack of plans to collaborate. Other studies have also emphasized that successful collaboration between disciplines and professions accustomed to working in different ways may not be a straightforward task, and will require specific attention in terms of training and partnership building (Anholt *et al.* 2012). In this vein, Stärk *et al.* (2015) have argued that thus far it has been easier to conduct One Health research than to build sustainable One Health systems. Noting surveillance as a key area of potential collaboration, they demonstrate that aside from a number of promising case examples including the joint FAO-OIE-WHO Global Early Warning System database, too often medical and veterinary data recording remains largely separate. As Zinsstag *et al.* (2011) and Stringer (2014) have argued elsewhere, making such collaborations sustainable will likely depend on making a persuasive economic case (see also Rushton *et al.* 2012).

One health and new technology

Whilst the preceding section outlines the main lines of debate over what One Health can achieve as a research and policy goal, other scholars have extended the concept in different, unexpected directions. One nascent body of literature highlights how the emergence of new technologies, which at first sight appear to support One Health goals of improved public health and nutrition, might actually call into question some of One Health's basic tenets. For example, Yates-Doerr (2015) explores the efforts of scientists to proffer the eating of insects as a solution to global food insecurity and an alternative to more environmentally damaging forms of livestock production. Whilst the scientists have a global ambition of tackling problems, Yates-Doerr finds that there is not *One World* when it comes to creating products, appetites and markets for edible insects, but many different worlds; and as such insect food solutions must be modified according to the specific locales in which they are to be consumed.

Investigating another emerging technology, Lezaun and Porter (2015) use the example of transgenic animals to question the One Health assumption that pathogen circulation is inevitable and that it is therefore ill advised to circumscribe health policy to the well-being of humans alone (FAO *et al.* 2008). Anticipating a potential future in which transgenic species could be rolled out en masse, the authors note the fundamental difference in strategy ascribed to the two camps: if One Health represents a strategy of *containment* (i.e. accepting that pathogens will always exist), transgenic animals represent one of

competition (i.e. that some might be engineered out of existence):

Thus, while [OneWorld - One Health] programstry to maintain an equilibrium in the human-animal interface...transgenic strategiesdeliberately provoke a new ecological dynamic by introducing varieties of thehost and vector species able to out-compete pathogen-carrying populations. (Lezaun and Porter, 2015, 97)

In short, various emerging technologies are poised to alter the ways in which humans and animals interact, and championing an approach that is attentive to the complex, multifaceted changes such developments are likely to bring will be a key task for One Health research in the near future.

One Health and expanding the remit of global health

As we have shown, some One Health advocates challenge global health actors to take a broader view of the causes of disease, and to consider different starting points for interventions. A possible further step in this line of thought is that the well-being of animals and the environment have an intrinsic value that is not tethered to their impact on humans. Therefore, so the argument goes, these non-human forms of life are themselves worthy of protection. Such topics have often raised complex and contentious ethical issue, for instance over trade-offs between animal welfare and food security (Marie, 2006). Whilst such questions are currently on the fringes of One Health debates, if One Health concepts are to contribute to these longstanding questions, their main contribution may be to emphasize global interconnectedness:

In a global economy where animal welfare policy decisions in one country can impact food costs, wild-life habitats, and energy consumption across multiple nations, these concerns can no longer be addressed without a broader vision. (Colonius and Earley, 2013, 309)

Finally, several authors have argued that the One Health agenda should include a number of hitherto marginal topics. For instances, Mills and Hall (2014) argue that whilst companion animals for people are sometimes dismissed as 'a luxury or unnecessary indulgence', a formidable body of research now attests to the therapeutic and developmental significance of the human-animal bond. Similarly, Sandøe *et al.* (2014) explore the relationship between the obesity of pets and their owners, noting that the pathogenic lifestyles that drive ill health cross, in a sense, the species boundary. Extending the notion that human and domestic animal health can be addressed together, other authors have, for instance, demonstrated the importance of accommodating pets in natural disaster

evacuations (Stauffer and Conti, 2014) or noted the human behaviours that make dog attacks on people more likely (Mannion and Shepherd, 2014). If one considers the core project of One Health to be advocating for better defences against zoonotic diseases or reforming global health, such issues may seem somewhat peripheral. But they nonetheless highlight the sheer breadth of ways in which human and animal well-being intersect, and perhaps more opportunistically, the value of attaching various projects to an agenda with some momentum.

Concluding remarks

At its simplest, One Health is both an assertion of the undeniable benefits of collaboration, and a useful overarching concept for asserting the value of a range of issues that might otherwise be marginalized and fragmented. For parasitologists, this offers a renewed opportunity for specialists in, for instance, zoonotic parasites and wildlife parasitology, to shape wider debates over research and interventions. This is a practical and intellectual project of great value, and has understandably generated interest and enthusiasm from a wide range of scholars and professionals. The challenge for the future is to ensure that this broad base of support does not collapse and splinter under its own weight. As we have shown, there is considerable debate over what exactly One Health is for. After all, One Health offers an implicit critique of current practice, and from their various vantage points, actors have different ideas on where the most pressing need for change lies.

Fortunately, many of the different visions of One Health are complementary – or at least, not mutually exclusive. It need not be a contradiction to carefully plan interventions that make use of a full range of disciplinary and professional knowledge whilst also asking broader, structural questions about global health priority setting. The success of both projects will likely turn on the quality of collaborations involved. Similarly, complexity theory offers a potentially powerful framework for describing multifaceted, unpredictable systems – yet it challenges established ways of working in a manner that make both natural and social scientists uneasy. The task now is to do more than simply call for better exchanges of knowledge, but to understand what kinds of policies, funding and institutions might enable such interdisciplinarity to flourish. A clearer understanding of the historical antecedents of One Health would be of great help, as would contemporary comparative studies that reflect frankly on the challenges of pursuing One Health, as well as simply championing the concept.

Ultimately, the wide-ranging, even unruly nature of the One Health debate is a sign of the promise of the concept. If the topics and the participants in the

conversation become pared down to a narrow, homogenous group, Galaz *et al.* (2015, 21) will surely be right that ‘One Health runs the danger of getting siloed and institutionalized with new forms of funding and power...becoming subject to precisely the problem it has sought to challenge’. Instead, researchers and practitioners must continue to find better ways to engage with one another, even if doing so raises unsettling, challenging questions about our own methods and perspectives. After all, the clear lesson of this emerging literature is that One Health cannot be achieved simply as an apolitical, technical project. If it to succeed, researchers and practitioners alike must engage with the political, social and economic questions that are at the heart of One Health.

ACKNOWLEDGEMENTS

We would like to thank organisers and participants of various conferences who facilitated discussion and feedback on previous versions of this paper, specifically the British Council workshop on One Health at the Southern African Wildlife College (January 2015), the International Studies Association Annual Conference in New Orleans (February 2015) and the British Society for Parasitology Autumn Symposium (September 2015). We also thank Professor James Smith (University of Edinburgh), who commented on an earlier version of this paper, and two anonymous reviewers.

FINANCIAL SUPPORT

This work has been supported by the European Research Council (grant no: 295845; <http://erc.europa.eu>). The funder had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

REFERENCES

- Anholt, R. M., Stephen, C. and Copes, R. (2012). Strategies for collaboration in the interdisciplinary field of emerging zoonotic diseases. *Zoonoses and Public Health* **59**, 229–240.
- Bardosh, K., Inthavong, P., Xayaheuang, S. and Okello, A. L. (2014). Controlling parasites, understanding practices: the biosocial complexity of a One Health intervention for neglected zoonotic helminths in northern Lao PDR. *Social Science & Medicine*, **120**, 215–223.
- Bresalier, M., Cassidy, A. and Woods, A. (2015). One Health in history. In *One Health: The Theory and Practice of Integrated Approaches* (eds. Zinsstag, J., Schelling, E., Waltner-Toews, D., Whittaker, M. and Tanner, M.), pp. 1–15. CABI Publishing, Wallingford, UK.
- Brown, K. (2008). From Ubombo to Mkhuzi: Disease, colonial science, and the control of nagana (livestock trypanosomiasis) in Zululand, South Africa, c. 1894–1953. *Journal of the History of Medicine and Allied Sciences* **63**, 285–322.
- Brown, K. (2014). Environmental and veterinary history—some themes and suggested ways forward. *Environment and History* **20**, 547–559.
- Chambers, R. and Conway, G. (1992). *Sustainable Rural Livelihoods: Practical Concepts for the 21st Century*, IDS Discussion Paper 296, Institute of Development Studies, Brighton.
- Chien, Y. J. (2013). How did international agencies perceive the avian influenza problem? The adoption and manufacture of the ‘One World, One Health’ framework. *Sociology of Health & Illness* **35**, 213–226.
- Coffin, J. L., Monje, F., Asiimwe-Karimu, G., Amuguni, H. J. and Odoch, T. (2015). A One Health, participatory epidemiology assessment of anthrax (*Bacillus anthracis*) management in Western Uganda. *Social Science & Medicine* **129**, 44–50.

- Colonus, T. J. and Earley, R. W.** (2013). One welfare: a call to develop a broader framework of thought and action. *Journal of the American Veterinary Medical Association* **242**, 309–310.
- Eyben, R.** (2013). *Uncovering the Politics of 'Evidence' and 'Results'. A Framing Paper for Development Practitioners*. Institute of Development Studies, Brighton. <http://www.ids.ac.uk/publication/uncovering-the-politics-of-evidence-and-results-a-framing-paper-for-development-practitioners>
- Ferrari, M. J., Grais, R. F., Bharti, N., Conlan, A. J. K., Bjørnstad, O. N., Wolfson, L. J., Guerin, P. J., Djibo, A. and Grenfell, B. T.** (2008). The dynamics of measles in sub-Saharan Africa. *Nature* **451**, 679–684.
- Food and Agricultural Organization, UNICEF, UNSIC, WHO, OIE, World Bank** (2008). *Contributing to One World, One Health: A strategic framework for reducing risks of infectious disease at the Animal-Human-Ecosystems Interface*. <http://ftp.fao.org/docrep/fao/011/aj137e/aj137e00.pdf>
- Galaz, V., Leach, M., Scoones, I. and Stein, C.** (2015). *The Political Economy of One Health Research and Policy*. STEPS Working Paper 81. STEPS Centre, Brighton, UK.
- Gibbs, E. P. J.** (2014). The evolution of One Health: a decade of progress and challenges for the future. *Veterinary Record* **174**, 85–91.
- Giles-Vernick, T., Owona-Ntsama, J., Landier, J. and Eyangoh, S.** (2015). The puzzle of Buruli ulcer transmission, ethno-ecological history and the end of “love” in the Akonolinga district, Cameroon. *Social Science & Medicine* **129**, 20–27.
- Godfroid, J., Al Dahouk, S., Pappas, G., Roth, F., Matope, G., Muma, J., Marcotty, T., Pfeiffer, D. and Skjerve, E.** (2013). A “One Health” surveillance and control of brucellosis in developing countries: moving away from improvisation. *Comparative Immunology, Microbiology and Infectious Diseases* **36**, 241–248.
- Greter, H., Vreni, J. R., Crump, L., Béchir, M., Alfoukh, I. O., Schelling, E., Bonfoh, B. and Zinsstag, J.** (2014). The benefits of ‘One Health’ for pastoralists in Africa. *Onderstepoort Journal of Veterinary Research* **81**, E1–03.
- Hinchliffe, S.** (2015). More than One World, more than One Health: re-configuring interspecies health. *Social Science & Medicine* **129**, 28–35.
- Jenkins, E. J., Simon, A., Bachand, N. and Stephen, C.** (2015). Wildlife parasites in a One Health world. *Trends in Parasitology* **31**, 174–180.
- Kaplan, B., Kahn, L. H., Monath, T. P. and Woodall, J.** (2009). ‘One Health’ and parasitology’. *Parasites and Vectors*. **2**, 36.
- Kayunze, K. A., Kiwara, A., Lyamuya, E., Kambarage, D. M., Rushton, J., Coker, R. and Kock, R.** (2014). Practice of One Health approaches: bridges and barriers in Tanzania. *Onderstepoort Journal of Veterinary Research* **81**, E1–E8.
- Lemos, M. C. and Rood, R. B.** (2010). Climate projections and their impact on policy and practice. *Wiley Interdisciplinary Reviews: Climate Change* **1**, 670–682.
- Lezaun, J. and Porter, N.** (2015). Containment and competition: transgenic animals in the One Health agenda. *Social Science & Medicine* **129**, 96–105.
- Liverani, M., Waage, J., Barnett, T., Pfeiffer, D. U., Rushton, J., Rudge, J. W., Loevinsohn, M. E., Scoones, I., Smith, R. D., Cooper, B. S., White, L. J., Goh, S., Horby, P., Wren, B., Dundogu, O., Woods, A. and Coker, R. J.** (2013). Understanding and managing zoonotic risk in the new livestock industries. *Environmental Health Perspectives* **121**, 873–877.
- Mannion, C. J. and Shepherd, K.** (2014). One Health approach to dog bite prevention. *Veterinary Record* **174**, 151–152.
- Marie, M.** (2006). Ethics: the new challenge for animal agriculture. *Livestock Science* **103**, 203–207.
- Mills, D. and Hall, S.** (2014). Animal-assisted interventions: making better use of the human-animal bond. *Veterinary Record* **174**, 269–273.
- Morse, S., McNamara, N. and Acholo, M.** (2009). *Sustainable Livelihood Approach: A critical analysis of theory and practice*. The University of Reading, Geographical Paper No. 189. <http://www.reading.ac.uk/web/FILES/geographyandenvironmentalscience/GP189.pdf>
- Mutsaers, I.** (2015). One-health approach as counter-measure against “auto-immune” responses in biosecurity. *Social Science & Medicine* **129**, 123–130.
- Mwacalimba, K. K. and Green, J.** (2015). ‘One Health’ and development priorities in resource-constrained countries: policy lessons from avian and pandemic influenza preparedness in Zambia. *Health Policy and Planning* **30**, 215–222.
- Neill, D. J.** (2012). *Networks in Tropical Medicine: Internationalism, Colonialism and the Rise of a Medical Speciality 1890–1930*. Stanford University Press, Stanford, USA.
- Okello, A. L., Bardosh, K., Smith, J. and Welburn, S.** (2014). One Health: past successes and future challenges in three African contexts. *PlosNTD* **8**, e2884.
- Okello, A., Welburn, S. and Smith, J.** (2015). Crossing institutional boundaries: mapping the policy process for improved control of endemic and neglected zoonoses in sub-Saharan Africa. *Health Policy and Planning* **30**, 804–812.
- Ramalingam, B.** (2013). *Aid on the Edge of Chaos: Rethinking International Cooperation in a Complex World*. Oxford University Press, Oxford.
- Robertson, L. J., Utaaker, K. S., Goyal, K. and Sehgal, R.** (2014). Keeping parasitology under the One Health umbrella. *Trends in Parasitology* **30**, 369–372.
- Robin, L.** (1997). Ecology: a science of empire. In *Ecology and Empire: Environmental History of Settlers* (eds. Griffiths, T. and Robin, L.), pp. 63–75. Keele University Press, Edinburgh, UK.
- Rock, M., Buntain, B. J., Hatfield, J. M. and Hallgrímsson, B.** (2009). Animal-human connections, “one health”, and the syndemic approach to prevention. *Social Science & Medicine* **68**, 991–995.
- Rushton, J., Häslér, B., De Haan, N. and Rushton, R.** (2012). Economic benefits or drivers of a ‘One Health’ approach: Why should anyone invest? *Onderstepoort Journal of Veterinary Research* **79**, 461.
- Sandøe, P., Palmer, C., Corr, S., Astrup, A. and Bjørnvad, C. R.** (2014). Canine and feline obesity: a One Health perspective. *Veterinary Record* **175**, 610–616.
- Scoones, I.** (2009). Livelihoods perspectives and rural development. *The Journal of Peasant Studies* **36**, 171–196.
- Scoones, I. and Foster, P.** (2010). Unpacking the international response to avian influenza: actors, networks and narratives. In *Avian Influenza: Science, Policy and Politics (Pathways to Sustainability Series)* (ed. Scoones, I.), pp. 207–226. Earthscan Publishing, London, UK.
- Sen, A.** (1981). *Poverty and Famines: an Essay on Entitlement and Deprivation*. Oxford University Press, Oxford.
- Singer, M.** (1994). AIDS and the health crisis of the U.S. urban poor; the perspective of critical medical anthropology. *Social Science & Medicine* **39**, 931–948.
- Shackley, S. and Wynne, B.** (1996). Representing uncertainty in global climate change science and policy: boundary-ordering devices and authority. *Science, Technology & Human Values* **21**, 275–302.
- Smith, J., Taylor, E. M. and Kingsley, P.** (2015). One World-One Health and neglected zoonotic disease: elimination, emergence and emergency in Uganda. *Social Science & Medicine* **129**, 12–19.
- Stärk, K. D. C., Kuribreña, M. A., Dauphin, G., Vokaty, S., Ward, M. P., Wieland, B. and Lindberg, A.** (2015). One Health surveillance – more than a buzz word? *Preventative Veterinary Medicine* **120**, 124–130.
- Stauffer, K. E. and Conti, L.** (2014). One Health and emergency preparedness. *Veterinary Record* **175**, 422–425.
- Stringer, A.** (2014). Improving animal health for poverty alleviation and sustainable livelihoods. *Veterinary Record* **175**, 526–529.
- Thompson, R. C. A.** (2013). Parasite zoonoses and wildlife: one health, spillover and human activity. *International Journal for Parasitology* **43**, 1079–1088.
- Tilley, H.** (2011). *Africa as a Living Laboratory: Empire, Development, and the Problem of Scientific Knowledge 1870–1950*. University of Chicago Press, Chicago, USA.
- Valeix, S.** (2014). *Toward One Health? Evolution of International Collaboration Networks on Nipah Virus Research from 1999–2011*. STEPS Working Paper 74, STEPS Centre, Brighton.
- Wald, P.** (2007). *Contagious: Cultures, Carriers, and the Outbreak Narrative*. Duke University Press, Durham, NC.
- Walker, A. R.** (2011). Eradication and control of livestock ticks: biological, economic and social perspectives. *Parasitology* **138**, 945–959.
- Wallace, R. G., Bergmann, L., Kock, R., Gilbert, M., Hogerwerf, L., Wallace, R. and Holmberg, M.** (2015). The dawn of structural One Health: A new science tracking disease emergence along circuits of capital. *Social Science & Medicine* **129**, 68–77.
- Wilcox, B. A. and Colwell, R. R.** (2005). Emerging and reemerging infectious diseases: biocomplexity as an interdisciplinary paradigm. *EcoHealth* **2**, 244–257.
- Woods, A. and Bresalier, M.** (2014). One Health, many histories. *Veterinary Record* **174**, 650–654.
- Yates-Doerr, E.** (2015). The world in a box? Food security, edible insects, and ‘One World, One Health’ collaboration. *Social Science & Medicine* **129**, 106–112.
- Zinsstag, J., Schelling, E., Waltner-Toews, D. and Tanner, M.** (2011). From “one medicine” to “one health” and systemic approaches to health and well-being. *Preventive Veterinary Medicine* **101**, 148–156.
- Zinsstag, J., Meisser, A., Schelling, E., Bonfoh, B. and Tanner, M.** (2012). From ‘two medicines’ to ‘One Health’ and beyond. *Onderstepoort Journal of Veterinary Research* **79**, 1–5.