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# Is there really such a thing as “one health”? Thinking about a more than human world from the perspective of cultural anthropology



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## ABSTRACT

Today's era of globalization is characterized by intensified interspecies encounters, growing ecological concerns and the (re-)emergence of infectious diseases, manifesting themselves in the interplay of medical and biological, but also social, cultural and political processes. One health approaches – which combine multidisciplinary efforts to stimulate collaborations between different health professionals such as veterinarians, medical practitioners, biologists, and public health professionals – can be understood as a response to this complex interconnectedness. Integrating a social science perspective might prove beneficial to this endeavor. This essay locates the one health discussion on disease ecologies in a more than human world within recent developments in cultural and medical anthropology that focus on the entanglements between health and a multitude of animals, plants or microbes, as they are characteristic of a globalized modernity. The paper aims to examine the social dimensions of human–animal–disease–interactions, claiming that disease is a biocultural phenomenon and that social factors generally play a crucial role in the emergence, spread and management of (infectious) disease. Consequently, it will be argued that there is a need to rethink our objects of inquiry and any given assumptions of human health, the human body or the constitution of “the global” as such. Incorporating the social sciences into one health approaches can help address topics such as consumption patterns, human–animal behavior or environmental conflicts in a novel way and on a grander scale than ever before. Yet, a greater sensitivity to context may entail some skepticism about the idea of one health – not in spite of the complex entanglements between humans, environments, animals and pathogens, but precisely *because* of them.

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## 1. Introduction

One health approaches – often believed to reflect a paradigm shift within health care and the health sciences (Bousfield and Brown, 2011; Kaplan, 2011) – are situated in the globalized context of contemporary modernity. They promote the integration of human, environmental, and animal health through trans-disciplinary cooperation and communication and they seek to understand the complex disease interactions between microbes, domesticated animals and wildlife, humans, and their environments as brought about by ongoing globalized networking processes (Rock et al., 2009). The contemporary human–animal relationship – which is central to this endeavor – is considered to be “complex and profound, ranging from exploitation of livestock for food and anthropomorphisation of animals as pets, to live ‘wet markets’ and international trade in animal species” (Zinstag et al., 2012, p. 107), and its impact is believed to constitute a threat to

all humans on an equal proportion. Most scholars working within this field of research pay particularly close attention to zoonotic diseases – that is, diseases caused by pathogens that can be transmitted from animals to humans and also from humans to animals (e.g., HIV, influenza, Lassa Fever) – and aim to explore the health and disease impact caused by a broad ranges of hosts.

With the concept “one health” originally being coined by veterinarian Calvin W. Schwabe in 1984 (Zinstag et al., 2012), the one health movement – stretching back as far as to pathologist and medical doctor Rudolf Virchow in 1858 – has its academic roots in veterinary and human medicine but is not limited to those disciplines. In this article, the term “one health” will be used as a general framework for describing a broad range of approaches that aim to think about human and animal health in an integrative way. “One World One Health,” however, is a trademark protected term resulting from an expert consultation in Canada in 2009 (for a detailed description of “one medicine,” “one health” and “One Health,” see Zinstag et al., 2011). Today, a wide scope of fields, including those in comparative medicine, public health, the

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environmental sciences, biochemistry, nursing science, and plant pathology, are taking shape under the umbrella term one health, and integrative approaches are institutionalized in organizations such as the WHO, the Food and Agriculture Organization or the Resilience Alliance. However, in spite of this heterogeneity, it seems noteworthy to mention that the social sciences are much less present in the one health research-agenda, and it is in this context that central terms and concepts like “*globalization*,” “*nature*,” or the “*body*” might benefit from the integration of a social science perspective.

By acknowledging the fact that we share our social, political, and medical landscapes with numerous biological beings, approaches centered on “one health” convincingly argue that the governance of zoonotic diseases cannot merely be concerned with human health alone:

The One Health concept is a worldwide strategy – a paradigm shift – for expanding interdisciplinary collaborations and communications in all aspects of health care for humans and animals. The synergism achieved will advance health care for the 21st century and beyond by accelerating biomedical research discoveries, enhancing public health efficacy, expeditiously expanding the scientific knowledge base, and improving medical education and clinical care. When properly implemented, it will help protect and save untold millions of lives in present and future generations (Monath et al., 2010, p. 193).

As this extract explains, it becomes clear that there is a growing recognition that the complexity of disease ecologies brought about by increasing global connectivity can only be explored by international and interdisciplinary cooperation. Since the 1990s, the holistic idea that human health is closely linked to the social, physical and biological environments that people inhabit has become more prominent, as is reflected, for example, by ecohealth and ecosystem approaches which offer the prospect of understanding these complex interactions and translating them into development strategies. Contributions made through the implementation of ecosystem approaches can be foreseen, for example, in the Ramsar Convention on Wetlands (RCW), an intergovernmental treaty aimed at the conservation of wetlands – ranging from swamps, lakes and mangroves to coral reefs and fens – and their biological diversity. Since its adoption in 1971, the RCW has provided a framework for international cooperation as well as for national action. Each of the contracting parties, which meet every three years to promote policies and guidelines, have committed themselves to “work towards the wise use of all their wetlands through national land-use planning, appropriate policies and legislation, management actions, and public education”, to “designate suitable wetlands for the List of Wetlands of International Importance [...] and ensure their effective management”, and to “cooperate internationally concerning transboundary wetlands, shared wetland systems, shared species, and development projects that may affect wetlands” (RCW, 2008, p. 2). In its 2012 resolution on “Wetlands and health”, a number of possible contributions to the achievements of the UN’s Millennium Development Goals are invoked which illustrate the close interrelationship between wetland ecosystems, environmental health and infectious diseases – and the potential benefits of a programmatic implementation of ecosystem approaches: as many infectious diseases such as diarrhea, cholera or dengue are waterborne or occur in close proximity on water resources, interventions such as primary education in health and water, an increase in ecologically sustainable food production or the implementation of suitable water purification systems might help to overcome pressing health problems as well as to maintain the ecological character of wetlands (RCW, 2012). Although

development projects such as these focus on ecosystems and biodiversity, they nevertheless rely heavily on the recognition of human practices and the way they contribute to the shaping of landscapes, water resources and agriculture.

Human–animal interrelationships, however, are mostly treated as *biological* phenomena, picturing improved medical education and care as a solution to the problem of emerging zoonotic diseases. But, in thinking about contemporary human–animal encounters, it may be suggestive to situate them in wider natural–cultural borderlands. That is, seen from the perspective of cultural anthropology, research should question the actual scope, contradictions, effects, and reflections of microbial globalization processes. By applying ethnographic research methods – often including participant observations and in-depth interviews as well as providing a comparative perspective – anthropological approaches are sensitive to everyday practices and the numerous cultural, social, technological, political, and economical contexts within which these practices are enacted. These approaches contest traditional biomedical models accounting for disease emergence and transmission and focus instead on how biomedical knowledge is constructed to evaluate its standards and technologies. One of the most important features of anthropological theory is its recognition of *context*: in this line of inquiry, biology is no longer considered essentially universal just as culture is now believed to be an integral part of diseases, bodies, and biologies. Whereas the notion of “one health” is built upon the assumption of a shared biological destiny, the anthropological perspective might provide useful insights into the wide range of diverging practices, institutions, norms, and bodies that contribute to microbial globalization processes and their governance.

Anthropology’s interest in the shifting grounds of infectious disease etiologies and human biology overlaps and sometimes converges – at least partially – with epidemiology’s attempts to invest in studies that aim to capture patterns of migration and mobility: It is now widely acknowledged that the movements of people, pathogens and parasites affect the spread and transmission of infectious diseases in several ways. Epidemiological research on the demographics of malaria movement (Pindolia et al., 2013) or antimicrobial drug resistance (MacPherson et al., 2009) bears witness to the fact that human activities – such as interregional migration, waste management or the use of bed nets – have to be integrated into the modeling of infectious disease dynamics in order to fully assess emerging public health risks. Given the case of drug resistant malaria strains, for example, the implementation of successful intervention strategies depends strongly on the identification of transmission patterns, demographic groupings and migratory routines. From this point of view, MacPherson et al. (2009) argue that a paradigm shift is needed where pathogen-focused policies should be replaced by integrated approaches.

In this context, it is important for both – the natural and the social sciences – to recognize that the global embeddedness of infectious disease ecologies is a product of biological *and* social relations. Accordingly, the scope and impact of these relations cannot be understood by relying on given assumptions about the constitution of human health, the human body, or the constitution of “the global” as such. To put it briefly: what does “worldwide” mean and for whom? Whose bodies are included in discourses on microbial globalization processes? How are these processes interlinked with social practice? What knowledge on the constitution of human and other bodies emerges from these processes and how is it enacted locally? These are questions, among others, that might be useful for delineating the complex disease interactions between microbes, animals, humans, and their environments.

In this article, I seek to conceptualize the one health model in terms of processes of globalization and within the dualism of the

natural and the cultural. I will argue that it is not enough to simply recognize the linkages among humans, animals, and environments but, rather, in order to fully capture the impact of these linkages, they must be situated and contextualized. Central to this endeavor is, first, the notion of a global scope as it is inherent to one health thinking. Second, I will look at how social science approaches might help to situate “one health” as being not only consistent with underlying biological processes but as shaped by social practice, too. I will thus, argue that the concept of an embedded or molecularized body, as it will be discussed in the second part of the article, might prove useful to think with as a starting point.

## 2. How “global” is one health?

Our world is indeed a world of global embeddedness. Globalization does not only facilitate the movements of goods, people, technologies, standards, norms, and practices. Microbes, too, play an important role in the global circulation processes. While their traffic is currently expanding and quickening, microbes have of course always been mobile, as the examples of the Plague or the Spanish Flu aptly illustrate. It is in this context that it has become a truly frequent cliché to assume that microbes do not respect established borders (see [Elbe, 2008](#)). Although the transgressive potential of microbes to cross ontological and political borders exerts a great fascination for anthropologists and virologists, it will not be discussed in detail here (but see [Mayer and Weingart, 2004](#); [Villarreal, 2004](#)).

The term “globalization” – in the widest possible sense – refers to the worldwide linkages of social relations and social systems, both in their material and symbolic dimensions (see, for example, [Giddens, 1991](#)), and rose in prominence during the 1990s. While there is no general agreement among social scientists about the meaning, definition, or the consequences of globalization, it is nevertheless of great concern for many of them. It is in this context that Stephen Collier and Aihwa Ong ([2005](#)) identify three distinctive approaches to the transformation processes commonly associated with globalization: a tendency to conceptualize a “new order of things” (depicted, for example, as modernization or network society); the examination of local articulations of global forces; and finally the revision of some of our discipline’s fundamental analytical categories such as “culture” or “scape” (p. 3). Ong and Collier, however, do not focus on structural transformations as such but they suggest analyzing the shifting forms of global phenomena as they are articulated in specific domains through which “the forms and values of individual and collective existence are problematized or at stake, in the sense that they are subject to technological, political, and ethical reflection and intervention” (p. 4). The authors draw on Sarah [Franklin’s \(2005\)](#) ethnographic study on the refiguring of traditional notions of governance, biology, and economy in the emergence of a “global” stem cell industry, to illustrate how a new form of humanism is brought about, which no longer claims to relate to a certain culture or social group but to humanity and to human life as such. They are keen to emphasize – which is useful for our purposes here – that the actual scope of emerging forms of humanism is not necessarily all-encompassing but is commonly articulated within and closely connected to a particular political and technological setting. A careful observation of those processes that are characterized by instability, contingency and conflict might be useful for understanding how notions of global responsibility, global scope or “one health” are invoked within such settings as the implementation of surveillance systems, the marketing and distribution of drugs, or the debates on the property rights over a new virus, as the current example of MERS, the middle east respiratory syndrome, illustrates.

The global (and local) dimensions of cultural practices, norms, and artifacts, lately often discussed as assemblatic or shifting in form, have for a long time held a strong interest for anthropologists working on global health issues. Accordingly, the transnational mobility of risks, body parts, or biomedical standards is one of the most prominent areas of current medical anthropological research (see, for example, [Inhorn, 2003](#); [Scheper-Hughes, 2005](#); [Song, 2010](#); [Waldby and Mitchell, 2007](#)). Thus a number of questions arise in this context: how are technological innovations adapted to local contexts? How do they merge with traditional health behaviors? How are certain diseases conceptualized and treated within different communities? Why do diseases and bodies differ from context to context? Each of the previous questions are well established research questions in fields like medical anthropology, and they provide a rich area of ethnographic research: in his empirical study of dengue control programs in Nicaragua, for example, medical anthropologist Alex [Nading \(2012\)](#) explores why local anti-dengue campaigns – which advertise a participatory approach by integrating female community workers (*brigadistas*) into the management of urban mosquito populations – do not seem to solve the problem, in spite of rigorous education campaigns. These campaigns promote the vision of disciplined households where insects and humans are strictly kept apart, and they shift responsibilities to the female member of these households. Nading joined several teams of local *brigadistas* during their collective encounter, namely the hunt for hidden mosquito breeding sites such as bottle caps, flowerpots or coconut shells. He discovered not only the intimate pleasure of hunting, but also profound discrepancies between scientific attempts of separating insects from humans and the *brigadistas’* notion to accept their environment as a place of multiple interspecies encounters. Nading’s empirical findings stress the close material-semiotic entanglements between women and mosquitoes, both being depicted as “unsanitary” and “undisciplined” by public health strategies. The author suggests as well, that mosquito intervention campaigns might address the wrong participants: instead of integrating adult women, children would be ideal candidates, claims Nading, as the playfulness of the mosquito hunt and its close relation to urban nature poses an ideal area of activity for children. Consequently, as this study illuminates, the call for more rigorous advertisement campaigns and “more science” is doomed to failure. Other anthropological studies illustrate the tensions between local food practices and infectious disease control programs ([Lockerbie and Herring, 2009](#)), scrutinize the impact of Malaria eradication programs on mosquito behavior in the streets of Dar es Salaam ([Kelly and Beisel, 2011](#)) or focus on the diverging functions of domestic animals and their role in the transmission of infectious diseases such as Echinococcosis ([Fuller and Fuller, 1981](#)), often presenting critical and surprising clues for understanding complex infectious disease ecologies and potential control of them. It is against this backdrop that scholars, like anthropologist Cecil G. [Helman \(2007\)](#), depict the very nature of global health strategies as paradoxical and fraught with tension. While the spread of emerging infections, for example, requires health strategies that are global in scale, it is likewise impossible – given the diversity of local social worlds – to develop universal strategies that can be neatly adapted to any local context (p. 451).

Whereas the anthropological discourse on global health is often oriented to explaining global connections through ethnographic studies related to a certain form of life in a given context, public health and epidemiological approaches, however, are routinely engaged with the modeling of diseases in populations and communities, risk assessment, and the construction of health policies and intervention strategies. Yet, current epidemiological research suggests that challenges arising from the ongoing globalization of pathogens might be best solved by the application of systemic

approaches (Leischow et al., 2008), which are sensitive of social and environmental contexts and which understand health as a “quantitative and qualitative interaction and outcome process in social–ecological systems” (Zinstag et al., 2011, p. 153; Ostrom, 2007). Hence, transdisciplinary and synthetic approaches might prove beneficial to all disciplines involved, for example by applying ethnographically informed case-studies to explore mechanisms or patterns hinted at by epidemiological research in detail – although efforts need to be made to scrutinize the different conceptual and theoretical foundations of both disciplines (Béhague et al., 2008), especially when confronted with the complexity of global infectious disease ecologies.

It is in this context, however, that globalization needs to be understood as a double-edged sword that cuts both ways: while global interconnectedness contributes to the emergence, development, and spread of microbial agents, it is also central to the management of zoonoses. For example, as the case of SARS has aptly illustrated, sociotechnical networks not only serve as catalyzers in the global distribution of microbes, they also enable and facilitate the development of vaccines and the distribution of experts, drugs and safety standards.

Whereas many one health scholars emphasize the problems arising in globalized interfaces between human, animals, and environments, they do not aspire to theorize globalization as such: how does globalization relate to modernization? Why are some nations and areas considered to be more at risk for zoonotic diseases than others? In short, how “global” is one health?

In cultural anthropology, there is no definitive answer, one way or another, to this question. However, one important aspect to take into consideration is the fact that globalization processes are neither unidirectional nor homogeneous and that they do not bring about a world that is culturally (or biologically) homogenized. As multi-species anthropologist Anna Tsing (2000) convincingly puts it, “We should have to abandon the search for a single global future” (p. 344). From the perspective of cultural anthropology, necessary work remains to be done on the theoretical and methodological foundation of one health approaches, particularly concerning the underlying assumptions about the scope, global nature, and egalitarian quality of microbial threats.

In her ethnographic study on H5N1 in Indonesia, multispecies-anthropologist Celia Lowe (2010), for example, looked at the pathways, interrelations, and mechanisms of a new pandemic threat in 2005 and found a *multispecies cloud* where “forms of the human, animal, and microbe meet and where each sustains – and clouds – the limits and possibilities of the other” (p. 645). While her observation that biological entities do not organize themselves within well-bounded populations is in line with much of the one health approach, she also scrutinizes the underlying notion of the *global* scale of pandemics. Lowe argues that the framing of the newly emerging H5N1-epidemic as *global* must not only be understood as a construction but that it also shifted responsibilities from an issue in Indonesian national public health to international intervention initiatives, thereby blaming the native human and chicken populations for posing a threat to mankind worldwide and causing a massive poultry cull. Similar to literary theorist Priscilla Wald (2008), Lowe makes use of the concept of narrative to underline that the idea of a truly egalitarian threat only masks the fact that the assumed dynamics of the coming pandemic relies on a differentiation between “there” (Southeast Asia) and “here” (North America and Europe) and thereby articulates fears about a potentially deadly virus being brought to Western industrialized countries.

Whereas anthropological research on globalized disease ecologies probably will not engage in discussions about whether pandemic risks are truly egalitarian or not, anthropological

approaches might be useful to bring back questions of context, knowledge production, locality, and specificity into the domain of one health approaches. But, as Tsing, in her reflection of the current global situation cautions, “This is not, however, an argument for ‘local’ diversity; if anything, it is an argument for ‘global’ diversity and the wrongheadedness of imagining diversity [...] as a territorially circumscribed, ‘place-based,’ and anti-globalist phenomenon” (Tsing, 2000, p. 352). Accordingly, we should be able to articulate a critical notion of a more than human world, which rejects any naturalized assumptions about the scope, meaning, and impact of emerging infections. Central to this approach is a perspective that focuses on the social, biological, political, economical, and medical landscapes entangled within the broad diversity of human practices – and human bodies. The recognition of these entanglements does not only contest the very idea of being bounded against otherness but also hints to the fact that humanity – both in its symbolic and material dimensions – is always in a process of formation and becoming, and that spaces of becoming necessarily are fluent and fragmented.

### 3. Which bodies?

The first part of this article critically examined notions of a shared global biological destiny by outlining diverging concepts, practices and norms that shape microbial globalization processes and their impact on human and non-human populations as depicted in numerous ethnographically informed case studies. The second part of this article will go on to make the argument that the human body has to be understood as deeply coupled with its environment, and that these couplings – far from being mere biological ones – also play a crucial role in the shaping of human–animal–disease–interactions.

Given the transgressive potential of the globalization processes discussed above, it is not surprising, then, that human and microbial social worlds are mutually correlated rather than independent, a fact that one health approaches are keen to emphasize, and that they belong to the realm of the biocultural, a fact often stressed by social science approaches. Biological and ecological dimensions of microbial globalization processes are commonly recognized as playing a major role within human–animal interrelations and their health impact, as the following examples show. Frequently quoted cases in this context include the interaction of Salmonella bacteria and agricultural production patterns (Hall and Durrheim, 2011), influenza viruses, factory farming and migratory birds (Dwyer and Kirkland, 2011), the West Nile Virus outbreak at the Bronx Zoo (Wilcke, 2013) or spillovers from wildlife reservoirs affecting livestock such as the Hendra Virus (Bousfield and Brown, 2011).

Against this backdrop, Robert Hall and David N. Durrheim (2011) sketch some of the pressing questions arising from a broad range of hosts: “What determines pathogenicity of agents, with species specificity? What, in particular, makes bats an efficient vector of so many newly described infections? How do we determine whether an agent is a true pathogen? What factors determine whether an infection will cross a species barrier? What measures will most effectively limit the burden placed on veterinary and human health?” (p. 5). Answers to these questions, however, will facilitate the development of human and veterinary vaccines as well as the implementation of systems of infectious disease detection, surveillance, and response, but they do not fully exploit the *complexity* of disease ecologies. Just as problems arising from human–animal interfaces do not exclusively manifest themselves in molecular structures or the environment, human as well as animal health needs should be analyzed when situated in biological *and* socio-cultural relationships: the social determinants of human–animal–

disease-interactions are becoming increasingly important to the understanding, but also the management of, infectious diseases.

Seen from the perspective of cultural anthropology, there is a need for transdisciplinary approaches that recognize the bio-cultural constitution of health as part of the problem: human activity exerts a great influence over the environment, as well as over the structure of bodies and genomes. “Because culture is fundamental to human life, it cannot be separated from its biophysical environment,” as Gisli Palsson et al. (2012) argue convincingly in their attempt to sketch a research agenda which integrates the social sciences in environmental research (p. 11). By stressing the emergent (and vulnerable) nature of globalized environments, the authors aim to reframe *anthropos* – the human condition – in terms of dynamic interactions and interconnectedness. Consequently, established notions of how health and disease relate to culture and the human body should be critically analyzed in order to fully comprehend the health impact of globalized environments.

There is a need to rethink current conceptualizations of human–animal interactions in a way that takes account of the emergent and flexible character of the human body and its entanglement with the environment – this embeddedness produces a body which is imprinted by its social, political, and material environment, and which differs considerably from context to context. Possessing an enmeshed biological and social constitution, this body is relevant for understanding the scope of human–animal interrelations and their impact on health.

Against this backdrop, the concept of “one” health might be critically scrutinized: if the social sciences have taught us anything, it is that the notion of “one” universal, biological body is a construct and can no longer be considered a given reality. However, as conceptualizations of the body exert a strong influence over the way in which studies on infectious diseases are undertaken, it is crucial to theorize contemporary notions of the body in its material and social constitution. Knowledge, practices, technologies, and experiences of the body have shown to possess a mutable, dynamic character which becomes apparent when questioning the technologies applied in the regulation and deployment of bodies. Hence, the relationship between zoonotic diseases, the human body, and human health – as it is central to the one health movement – is marked by multiple determinations and shifting forms and must be understood in terms of flexibility and change.

Anthropologists and other social scientists have long sought to investigate forms of human embodiment that recognize the bio-cultural embedded constitution and the ongoing openness of the body, as it is reflected in attempts to explore the social determinants of health and disease. Although there is no general agreement about how to capture this openness theoretically and methodically, recently, a number of concepts and frameworks have been developed, ranging from composite (Bäckhed et al., 2005) to molecularized bodies (Lock, 2012), from epigenetics (Niewöhner, 2011) to the microbiome (O'Malley and Dupré, 2007), and from either the natural or the social sciences to transdisciplinary thinking and integrated approaches. Yet, the complexity of human embodiment poses a similarly fundamental challenge to the natural sciences, and we currently find intense debates over the functions of gut bacteria or the ecosystem's impact on human health (please see Table 1).

As a fruitful starting point into the analysis of embedded or molecularized bodies, one may follow the approach of the biological philosophers Maureen O'Malley and John Dupré (2007) and view our body as a “composite of many species” (p. 157, citing the work of Bäckhed et al., 2005). Drawing on the concept of the microbiome, they argue for the integration of interconnected and diverse microbiological perspectives in order to reconceptualize traditional notions of “life” or the body. The concept of the

**Table 1**

Approaches to diversity and human–environment-interaction within the natural sciences.

- 1) **Microbiome:** Recent genomic studies claim that the human body has to be understood as a supraorganism which not only consists of human cells, but also of a vast number of microbial organisms (such as bacteria, fungi or protozoa), being estimated to outnumber human cells ten to one. The totality of microorganisms and their genetic material, which coexist with the human body – the so-called microbiome – is believed to have a profound impact on the causation of diseases and the maintenance of health. The analysis of microbial communities might help us rethink our understanding of biological and cultural diversity as metagenomic methods provide a window into intra- and interpersonal species variations and their potential impact on health and disease predispositions (Benezra et al., 2012). Hence, research into the human microbiome also hints at the fact that our bodies are always in the process of formation and becoming, and that these processes are contingent on microbial and other environments. The permanent adaptation of our gut microbiome to changing dietary regimes might be one of the most prominent examples of these interactions. (Dove, 2013; Bäckhed et al., 2005; Hughes, 2012). Other studies point to the importance of intestinal microbes in resistance to autoimmune diseases (Leslie, 2012) or to the linkages between microbial and host behavior (Ezenwa et al., 2012). Combining metagenomic studies, for example on the gut microbiome, with anthropologically informed studies of human social lives and food practices might provide some insight into the complexity of human embodiment within different contexts (Benezra et al., 2012).
- 2) **Virome:** The virome – that is, the totality of viruses coexisting with the (human) body – is a constitutive part of the microbiome, but unlike the latter, not much is known yet about the virome's functions, composition or complexity. While some of these viruses and their genetic information may indeed be linked to the emergence of chronic diseases (e.g., cancer), others seem to provide their hosts with distinctive advantages such as enhanced immune responses to harmful pathogens (Lecuit and Eloit, 2013). Current approaches identify the human body as a human ecosystem, consisting of human, microbial, viral and other components, all of which are described as being subject to diverging environmental local conditions. Similarly to the microbiome, the virome shows intra- and interpersonal variations (Minot et al., 2013).
- 3) **Community Ecology:** The study of community ecology – a branch of ecological biology – examines how different species interact with one another and with their environments. Central to this approach is the assumption that species organize themselves in communities that vary over time and space and lack distinct boundaries, that they compete for resources such as food, mates, water, air and space, and that different environmental conditions have a profound impact on the outcome of these interactions. Conceptualized as a co-evolutionary and contingent dynamic, numerous mechanisms regulate species diversity; however, scholars of community ecology are particularly concerned with the interrelation between local and broader regional processes and its influence on biodiversity (Mittelbach, 2012; Morin, 2011).
- 4) **Ecohealth:** Closely related to one health approaches, ecohealth or ecosystem approaches aim to help us better understand how ecosystems impact human health and wellbeing. Different from one health scholars, advocates of ecosystem approaches apply a broader perspective on human health by integrating disciplines such as system science, philosophy and geography (Leung et al., 2012; Webb et al., 2010). The redefinition of human health in terms of sustainability, equity and social justice offers the prospect of understanding complex environmental interactions as well as delivering multi-stakeholder solutions to pressing environmental hazards and health-related problems such as noxious effects of occupational toxins or malaria vector control in urban environments.

microbiome has recently drawn attention to the contribution of microorganisms to the health and physiology of the human body. As multi-species scholars and natural scientists similarly stress, human organs, such as the skin or the intestines, depend on host–bacterial mutualisms that are beneficial to both humans and their microbial partners. Bäckhed et al. (2005), for example, picture the gut microbiota as an organ placed within the host's organ: “It is composed of different cell lineages with a capacity to communicate with one another and the host; it consumes, stores, and redistributes energy; it mediates physiologically important chemical transformations; and it can maintain and repair itself through self-replication. The gut microbiome, which may contain  $\geq 100$  times

the number of genes in our genome, endows us with functional features that we have not had to evolve ourselves” (p. 1915). The average human person nowadays is believed to harbor around 160 different species of gut microbiota (Hughes, 2012).

What is interesting about this perspective – in the context of attempts to study the social determinants of health – is that it allows us to rethink alliances and couplings between humans, microbes, and environments on both the biological *and* the social level: the genomic constitution and age of individuals, for example, might be as important as food practices, sexual preferences or consumption patterns. Hence, the microbial communities in our bodies are constantly subject to change, depending – among other factors – on age, diet, and environment and hereby are inherently linked to human health. In her ethnographic study on the making of raw-milk cheese in the United States, anthropologist Heather Paxson (2008) makes clear that it is worth investing in the potentialities of human and microbial practices which she understands as cultural and collaborative. She describes how farmers and artisan cheese makers are coupled with the materiality of their specific local soils (the *terroir*) through milk and cheese consumption, flavor components, and digestive processes, and she suggests that the natural–cultural human–microbial entanglements are the ongoing outcome and not the raw material of history and thereby always in a process of formation. What is interesting about her research, for our purposes here, is that it illustrates how the relationship between humans – farmers and cheese makers – and nonhumans – bacteria and milk cattle – is created and modified by cultural practices such as the pasteurization of milk, the feeding of cattle, the use of soap and towels, milking techniques or practices of food preparation. Taking this embeddedness of the human body seriously, particularly by blending biological dynamics, environmental effects and social practice analytically, might help to overcome simplistic “culturalistic” cause–effect relationships and the development of a thorough understanding of human embodiment within distinct historical and spatial contexts and infectious disease ecologies (Lock, 2012, p. 129). In other words, a critical ethnographically informed exploration of – often unquestioned – concepts such as “body” or “global” provides an important window into the complexity of the social determinants of health. As Marcia Inhorn and Peter Brown (2009) claim:

It is important to note that infection with a specific agent does not necessarily result in disease. This progression depends upon a number of intervening variables, including the pathogenicity of the agent, the route of transmission of the agent to the host, and the nature and strength of the host's response. All of these factors, in turn, are affected by the natural and social environments in which the agent and host are juxtaposed; in some cases, the environment may promote the transmission of the agent to the host, while in other cases it may limit or even prevent such transmission. Critical characteristics of the environment result largely from socio-political influences; thus, many infectious diseases, such as tuberculosis, are rightly considered ‘social diseases’ (p. 33).

Based upon the theoretical assumptions on globalization and the human body sketched above, serious questions remain, however, on the numerous couplings of human health with a more than human world, on the embodiment of infectious disease, on diverging explanatory approaches, on the construction and transgression of interspecies boundaries – questions that anthropology might address to the benefit of one health-approaches: Natalie Porter's (2012) study on avian flu management in Vietnam, for example, shows how boundaries between different species are constructed, enacted, and transgressed, and how this process re-organizes the

spatial and social relations between poultry, humans, and viruses, illustrating the limits of place-based approaches in the management of zoonotic diseases. Paul Farmer's (1997) insightful account of multi-drug-resistant tuberculosis (MDR TB) in Haiti sheds lights on the embodiment of TB, as he presents the bacterium as contingent of social forces (“ranging from racism to political violence,” p. 356). Stressing the social determinants of MDR TB, Farmer makes clear that poor housing conditions, economic inequalities and violence have an impact on the materiality of human–pathogen-interactions within the body which enable the TB bacterium to accumulate resistant mutations, witnessing the multiple ways biology is situated in time and space. Uli Beisel's and Christophe Boëte's (2013) account of genetically modified mosquitoes as an instrument for malaria control describes how insects are transformed from a potentially dangerous vector into a potentially beneficial tool, shifting attention “away from public health personnel or the people affected by the disease, instead it is centered on the body of the mosquito itself” (p. 55). Ethnographic approaches such as these can provide useful information on how people in different geographical regions determine whether an agent is a pathogen, on how differences in the enactment of interspecies boundaries relate to patterns of disease transmission or how social activities of humans impact the emergence and spread of microbes. While the above mentioned examples are by no means exhaustive, they might prove to be helpful in reevaluating the larger field of complex disease ecologies and their social determinants.

#### 4. Conclusion

A significant body of interdisciplinary work indicates that the era of globalization is also an era of intensified interspecies encounters, growing ecological concerns, and (re-)emerging infectious diseases. Micro and other organisms are not only an inescapable part of our medical and biological landscapes but also of our social, cultural and political milieu as well (Paxson, 2008). One health approaches bear witness to the fact that we have entered an era of rapid environmental change, population growth, species extinction, technological development, and the emergence of infectious diseases. This, in turn, requires rethinking our objects of inquiry.

In order to adequately understand the complexity of disease ecologies in globalized environments, it might not be enough to call for interdisciplinary collaborations of human and veterinary medicine and of public health and the environmental sciences – although this is an important step. But, as I hope to have made clear in this article, with health being our object of inquiry, another set of factors – apart from the biological ones – is becoming increasingly important: namely the social determinants of human–animal–disease-interactions (the WHO for example integrated the social determinants of health into one of their strategic programs; see WHO, 2010b). As biocultural phenomena, health care practices and the human body have to be situated into the numerous cultural, social, technological, political, and economical contexts within which these practices are enacted. By recognizing infectious disease ecologies as a product of social relations, it becomes apparent that in order to understand the scope and impact of these relations, we cannot rely on any given assumptions about the constitution of human health, the human body, or the constitution of “the global” as such. In fact, adding a social science perspective to one health approaches might help to study human–animal behavior, food practices, health beliefs, barriers, conflicts and environmental interactions on a much grander scale than ever before. But on the other hand, a greater sensitivity to context may also give rise to doubts about the idea of “one health” – not in spite of the complex disease interactions between microbes, domesticated animals and wildlife, humans and their environments, but *because* of them.

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