Part III
Diseases

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African Buffalo and Diseases, and the Villain is…

All iconic wildlife species trigger an array of positive and negative feelings, beliefs and values in humans. The lion is the king of the savanna, powerful and dangerous but benevolent towards his subjects. The African buffalo, on the other hand, is aggressive, naughty and treacherous. These perceptions do not only draw their strength from the ferocious opponent that the buffalo represents when hunted. They also are deeply rooted in the perceived relationship between the buffalo and infectious diseases, and the negative representations associated with the buffalo as a villainous animal spreading pathogens to livestock. In Africa, and perhaps even beyond, no other species crystallizes so many of perceptions about the health risks that need to be controlled to produce livestock. Managing buffalo populations, by culling them, physically disconnecting them from livestock and protecting livestock from their diseases, has been one of the priorities of colonial and post-colonial veterinary services since their creation at the end of the nineteenth century. This section of the book aims to review the current state of knowledge on the relationship between the buffalo and infectious diseases, and then to reflect on old paradigms and opportunities provided by new knowledge and global contexts.

To do so, we first needed to present recent data and synthetize knowledge about the role of buffalo in infectious diseases in Africa. The buffalo is a species that co-evolved with African pathogens and their vectors, developing resistance and tolerance mechanisms that has allowed it to survive across the continent in different habitat types. However, it is far from clear that the buffalo is a maintenance host for all or many endemic pathogens. Gaps in knowledge still exist despite the massive amount of work that has been done on the species. With regard to European and

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Asian pathogens that have been imported into Africa since the beginning of the colonial era, buffalo have once again proved to be a quite resistant species. The one exception was the deadly and now extinct rinderpest, which hammered buffalo populations in Africa. The picture that emerges from this section is that compared to exotic cattle breeds, the buffalo is a quite robust species well adapted to the African terrain. As a result, in the current intensive livestock production systems promoted in Africa, the buffalo needs to be separated from livestock because of its maintenance of some diseases detrimental for livestock production. Does the same hold for extensive subsistence farming systems?

The last decades have seen the emergence of a relatively larger number of behavioural studies looking at the buffalo/cattle interface in relation to pathogen ecology. These studies have been concentrated in southern and eastern Africa and are largely absent in other regions. They require interdisciplinary collaboration bridging ecology, spatial epidemiology and social sciences, among others. The replication of these studies in different ecosystems has indicated that buffalo tend to avoid cattle, leading to very few observations of direct contacts (only the odd story of a buffalo bull hanging around a cattle herd, but probably not a common event). Buffalo tend to use similar grazing and water sources because cattle are penned ('corralled', 'kraaled') at night, adapting their behaviour to the contexts of wildlife/livestock interfaces. This means that potential interspecies transmission is more likely to involve pathogens that are indirectly transmitted (e.g. through the environment or vectors). This new science of the wildlife/livestock interface still needs some development. More data-heavy modelling will help the testing of management options for these interfaces, such as manipulating key resources (e.g. water, grazing) or strategically controlling the disease in cattle (e.g. seasonal vaccination protecting cattle when contacts with buffalo are the highest). The integration of non-invasive tools and genomics should considerably impact the understanding of these buffalo/cattle interfaces.

The entanglement of the buffalo in grievances because it was thought (unjustifiedly) to cause sanitary issues had the advantages of concentrating a huge amount of disease ecology work on the species. Today, the buffalo belongs to the top five species in the world studied for *in vivo* coinfection. Its gregarious social organization and phylogenetic proximity with cattle, with whom they share a large part of their pathogen burden, makes the buffalo a formidable subject to investigate the little-known interactions of important viruses, mycoplasmas, other bacteria and parasites in coinfected individuals and populations. Interesting

coinfection properties emerge from these studies that emphasize potential cooperation or competition between pathogens through the intermediary of the host immune systems and the relevance of the infection history of the host to determine the community of pathogens that it harbours. The knowledge and hypotheses produced by these studies can inform not only the management of buffalo and buffalo/cattle interfaces (e.g. shall we manage pathogens in buffalo populations or not), but also the nascent field of pathogen community ecology.

After weighing and sifting through the evidence, it would appear that the African buffalo is probably not the health villain invented by colonial administrations. Its coexistence with Western livestock production systems is probably impossible and has been fought against during the twentieth century. But what have been the costs and benefits for African societies? Is the species that is well-adapted to the African environment the problem, or is it the imported breed that needs to be kept under unsustainable conditions to stay productive? The twenty-first century has started with the prospect of massive global changes for the century to come that will threaten societies and their productive systems. There is a chance that Africans and African societies could emerge stronger from this challenging era, and the buffalo could be a flagship of this transformation.