International Journal for Parasitology: Parasites and Wildlife 3 (2014) A1–A2

Contents lists available at ScienceDirect

International Journal for Parasitology: Parasites and Wildlife

journal homepage: www.elsevier.com/locate/ijppaw

Parasitology and One Health

One Health is certainly a topical, one could say trendy area to espouse and exploit as a positive driver for multidisciplinary activities and research funding. One Health is also increasingly incorporated into undergraduate and graduate teaching related to health and disease, broadly defined, and into public policy. As a concept it has great potential if considered in terms of the conceptual framework of the One Health triad that encompasses humans, domestic animals and wildlife, and the changing environments they share, as well as factors which can influence the flow of infections within these environments. Currently, however, One Health is used mostly as a vehicle to emphasise the emergence of 'new' human diseases (Polley, 2005; Jones et al., 2008; Plowright et al., 2011; Wood et al., 2012; Kooriyama et al., 2013). Thus a somewhat unbalanced view predominates, particularly in terms of the roles of ecosystem structure and function and of wildlife, the latter often viewed as villains in a One Health scenario focused on the public health impacts of emerging infections. As such, there is little emphasis on eukaryotic parasites but more on viruses and bacteria (Thompson, 2013).

It was therefore pleasing to see the title of a recent article: "Keeping Parasitology under the One Health Umbrella" (Robertson et al., 2014). This article presented many reasons and examples supporting the need for an increased emphasis on specific parasitic infections and diseases within One Health, but missed an opportunity to emphasise the relevance of a One Health approach to these and many other host-parasite assemblages. Additionally, 'One Health' was not defined and the authors concentrated on discouraging the common focusing of One Health on emerging infectious diseases in humans and encouraging the inclusion of established parasitic diseases such as Chagas, cysticercosis, and crytosporidiosis. Other than they are zoonotic and/or of public health significance, why such parasitic diseases should be under the 'One Health umbrella' is not discussed, despite the importance of wildlife reservoirs for several of the parasites listed, of environmental features essential to vectors, of opportunities for 'spillovers', and of human behaviour in the transmission of many parasites. As such, there is so much more to illustrate the importance of considering why parasitology should be kept under the One Health umbrella. Indeed, parasites never left the One Health umbrella: it is just that their role has been overshadowed by the anthropogenic impacts, particularly those linked to wildlife. In practice the balance has been skewed towards demonstrating the 'source' of 'new' human diseases rather than determining 'why' in terms of One Health.

Considerations concerning emerging infectious diseases have often been reactive with little consideration given to the ecosystem changes that contribute to the occurrence of infection and disease, for example, the impact of biodiversity loss, encroachment, the role of invasive species, climate change and the conservation issues. If emerging infectious diseases have taught us anything, it is the need to gather more information about what parasites wildlife harbour and why disease is not common in these hosts unless perturbations occur that influence infections becoming diseases. We know very little of the natural parasite faunal structure of many wildlife, including those that can be transmitted to humans and/or domestic animals. There is an incredible lack of knowledge about pathogen diversity and susceptibility in wildlife (MacPhee and Greenwood, 2013). Without improved and ongoing surveillance of wildlife hosts (Kuiken et al., 2005; Polley, 2005; Grogan et al., 2014) not only will we always be behind in terms of predicting the possibility of reservoirs being established and/or outbreaks occurring, but also at a disadvantage in preventing declines of native fauna resulting from infectious diseases, including those caused by parasites (Thompson, 2013).

Examples of the features of parasites and parasitism in wildlife potentially important in One Health include: (1) the range of eukaryotic taxonomic groups that include parasites: helminths, arthropods and protozoa; (2) for parasite zoonoses, the availability of molecular techniques for the identification, of many parasite life cycle stages and invertebrate hosts, and in some cases parasite detection (Polley and Thompson, 2009); (3) the ability to count various life cycle stages of many helminths and arthropods, and some protozoa; (4) the sensitivity to temperature and moisture and other environmental conditions, shown by the free-living life cycle stages, and those in ectothermic hosts, both of which are essential for transmission of many parasitic helminths as well as some arthropods and protozoa; (5) the importance of food webs for the many helminths and some protozoa that depend on predator prey linkages for transmission and that can be affected by shifts in the structure and function of local ecosystems; (6) the wide range of definitive, intermediate and paratenic host species that can be infected by many helminths and protozoa, and some arthropods, including some of those transmissible to humans and/or domestic animals; (7) the importance of culture, tradition and behaviour in the occurrence of parasitic infection and disease in people; (8) the ubiquitous presence of polyparasitism and of mixtures of parasites, bacteria and viruses in all host groups that facilitates our understanding of linkages between different pathogens and between these mixed faunas and the hosts; (9) the difficulties in treating a range of parasitic infections in all host groups; (10) the very few vaccines available for the prevention of parasitic infections in any host group; and (11) the usefulness of a range of parasitic infections and diseases of all host groups as sentinels and probes of environmental and ecosystem change.

http://dx.doi.org/10.1016/j.ijppaw.2014.09.002

Thus parasites and parasitism have the potential to provide excellent frameworks and model systems for the application of One Health approaches to a range of infections and diseases. Successful One Health should promote both a pro-active approach to infectious disease – what might happen and why? – and a reactive approach – what do we do now that infection and/or disease has appeared? Parasites can also help to highlight some of the consequences of forces such as climate change, increasing urbanisation, shifts in land use, changes in agricultural and conservation strategies, and conflict-induced mass migrations, for the health and well-being of people, domestic animals and wildlife, as well as our physical environment and our increasingly fragile biosphere.

R.C. Andrew Thompson
School of Veterinary and Life Sciences, Murdoch University, Murdoch, WA 6150, Australia
E-mail address: a.thompson@murdoch.edu.au

Lydden Polley
Department of Veterinary Microbiology, University of Saskatchewan, Saskatoon, SK S7N5B4, Canada
E-mail address: lrp537@mail.usask.ca

References

Grogan, L.F., Berger, L., Rose, K., Grillo, V., Cashins, S.D., Skerratt, L.F., 2014. Surveillance for emerging biodiversity diseases of wildlife. PLoS Pathog. 10, e1004015.
Jones, K.E., Patel, N.G., Levy, M.A., Storeygard, A., Balk, D., Gittleman, J.L., et al., 2008. Global trends in emerging infectious diseases. Nature 451, 990–993.
Kooriyama, T., Okamoto, M., Yoshida, T., Nishida, T., Tsubota, T., Saito, A., et al., 2013. Epidemiological study of zoonoses derived from humans in captive chimpanzees. Primates 54, 89–98.
Kuiken, T., Leighton, F.A., Fouchier, R.A.M., LeDuc, J.W., Peiris, J.S.M., Schudel, A., et al., 2005. Public health: pathogen surveillance in animals. Science 309, 1680–1681.
MacPhee, R.D.E., Greenwood, A.D., 2013. Infectious disease, endangerment, and extinction. Int. J. Evol. Biol. 2013, 1–9.
Plowright, R.K., Foley, P., Field, H.E., Dobson, A.P., Foley, J.E., Eby, P., et al., 2011. Urban habituation, ecological connectivity and epidemic dampening: the emergence of Hendra virus from flying foxes (*Pteropus* spp.). Proc. Biol. Sci. 278, 3703–3712.
Polley, L., 2005. Navigating parasite webs and parasite flow: emerging and re-emerging parasitic zoonoses of wildlife origin. Int. J. Parasitol. 35, 1279–1294.
Polley, L., Thompson, R.C.A., 2009. Parasite zoonoses and climate change: molecular tools for tracking shifting boundaries. Trends Parasitol. 25, 285–291.
Robertson, L.J., Utaakes, K.S., Goyal, K., Sehgal, R., 2014. Keeping parasitology under the One Health umbrella. Trends Parasitol. 30, 369–372.
Thompson, R.C.A., 2013. Parasite zoonoses and wildlife: one health, spillover and human activity. Int. J. Parasitol. 43, 1079–1088.
Wood, J.L.N., Leach, M., Waldman, L., MacGregor, H., Fooks, A.R., Jones, K.E., et al., 2012. A framework for the study of zoonotic disease emergence and its drivers: spillover of bat pathogens as a case study. Philos. Trans. R. Soc. Lond. B. Biol Sci. 367, 2881–2892.