Editorial



# One health: a focus on interdisciplinary collaboration

## Editorial

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Kenneth C Shenge, Jeffrey T LeJeune
The Ohio State University, USA

**Correspondence:** Kenneth C Shenge, OARDC Food Animal Health Research Program, The Ohio State University, 1680 Madison Avenue, Wooster, OH 44691, USA, Tel 330-466-2316, Fax 330-263-3677, Email kcshenge@gmail.com

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The One Health concept recognizes that human health is connected to, and dependent on the health of animals, plants and the environment. Human beings and other organisms have coevolved on the earth for hundreds of millennia. Over time, they have come to depend on each other in a very intricate manner. The survival and welfare of the human species can only be guaranteed when our environment, plants and animals are in good health. Health is indivisible; the problems that confront plant agriculture are just a different manifestation of the same problems that confront the environment, animal agriculture and human health. The threats we currently face will persist until we confront them collectively, collaboratively and multidimensionally. The One Health concept is an important meeting point for research in the life and physical science.

It was previously thought that the extensive evolutionary chasm between plants and animals, and the vast differences in plant and animal structure, composition and environmental needs prohibited animal pathogens from thriving on plant hosts, and vice versa. However, in addition to pathogens like Erwinia spp., Burkholderia cepacia and Pseudomonas aeruginosa that have long been known to have jumped across the inter-kingdom gap, recent studies demonstrated that several other pathogens which cause some of the most devastating human and animal diseases have phases of their life cycles outside of the human and animal hosts. Many of the organisms that are able to infect hosts in animal and plant kingdoms are foodborne and are transmitted through fecal-oral and direct routes. Good examples of such pathogens include Shiga toxin-producing Escherichia coli, such as the O157:H7 serovar that causes thousands of foodborne illnesses in USA annually and serovar O104:H4 that caused the international and devastating outbreak in Europe in 2011. Symptoms of E. coli infection include abdominal cramps, bloody diarrhea, hemolytic uremic syndrome and kidney failure. Escherichia coli O157:H7 was first linked to human illness in 1975, with the first formal report of illnesses caused by the pathogen in 1982. Recently, association of Shiga toxin-producing E. coli with fresh produce has caused considerable concern that serovars of the organism have acquired ability to use plants as alternative hosts. These pathogens have manifested a remarkable degree of environmental fitness, evolving mechanisms that enable them to adapt to a wide range of ecological conditions. At the same time, long term changes in agricultural production and marketing systems that make fresh produce an easier target for mass human pathogen contamination, changes in vegetable consumption patterns and international travel have also played key roles in the evolution of plant, animal and human pathogens that are better able to jump hosts. The food safety problem is certainly a great example of a challenge that requires a One Health approach for resolution. There are many aspects of the biology, genetics, pathogenicity, host range and ecological needs of foodborne pathogens that are not yet well understood. Many important questions relating to the life of foodborne pathogens on plants remain to be answered. Other areas, such as types of associations between foodborne enteric pathogens and plant pathogens, horizontal gene exchange between enteric human pathogens and enterobacterial plant pathogens present an excellent opportunity for interdisciplinary research collaboration between plant pathologists, veterinary microbiologists, molecular biologists, animal scientists, ecologists and human health specialists.

Another challenge that is likely to be better resolved through a One Health approach is mycotoxicosis, a foodborne illness that results from consumption of aflatoxin-contaminated food and feed. It is estimated that a third of global food supplies are contaminated with aflatoxins. Even though crop diseases caused by mycotoxin-producing fungi significantly reduce yields, the major impact of the fungi and their toxins is on the health of animals and humans. And while stringent food quality regulations in USA and the European Union resulted in a significant decline in the incidence of mycotoxicosis in both regions in the last two decades, acute and chronic health problems resulting from mycotoxin-contaminated foods are still a major public health problem in the developing world. On a global basis, mycotoxicosis has proved to be a stubborn challenge to the health of crops, animals and humans. In spite of all the resources invested in the fight against them, some basic questions about mycotoxins, the fungi that produce them and their effects remain to be clearly understood. It is still not well understood why some fungi produce mycotoxins, and the evolutionary relevance of mycotoxins continues to be a puzzle. Some of the aspects that have received considerable research attention include animal and human genetic factors that influence susceptibility to mycotoxins, plant proteins associated with aflatoxin resistance in plant hosts, mechanics of mycotoxin-induced carcinogenicity mutagenicity and the whole range of damage done by aflatoxins. In spite the investments in such studies; they remain a work in progress. In view of these challenges, it is becoming increasingly apparent that a holistic approach that will produce the desired results would require concerted, multidisciplinary, collaborative efforts from plants scientists, microbiologists, animal scientists, biochemists, molecular biologists and human health workers.

From the foregoing, it seems completely appropriate that research funding agencies are increasingly demanding that grant applications have a multidisciplinary complexion. The problem solvers of tomorrow will be those who understand that the problems are multidimensional; those who approach the challenges in a holistic, collaborative and multidisciplinary fashion that attacks the problems from more than one angle.

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## Conflict of interest

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