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NEWS AND VIEWS

Two disciplines, one priority: the seamless integration of human and veterinary microbiology is urgent

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New threats to public health and agricultural production are emerging at a rate of at least one per year.

Over 30 threats that have appeared in the last three decades have had a serious impact, either locally or internationally, on health-care resources. Most have resulted from the crossing of species barriers from animals to humans, especially from wildlife reservoirs and domesticated animals. The majority are RNA viruses owing to the ability of the RNA genome to undergo rapid mutation and thus adapt to fluctuations in host population numbers and availability. Indeed, nearly 80% of all known RNA viruses naturally infect animals other than humans, perhaps the most relevant example being that of the influenza A viruses of aquatic birds that have successfully crossed the species barrier into pigs, poultry and horses.[1] Despite the increase in emergence, there has not been any new virus families discovered over the past two decades, and indeed those newly discovered viruses of recent years can be accommodated within the existing hierarchical family and genera classification system, for example, enterovirus 71.[2]

The situation is ever more complex when arthropod vectors are involved, and adaptation to new ecosystems becomes ever a possibility as a result of climate changes triggered by greenhouse gas emissions, forest clearing and the inexorable rise in the percentage of the human population now living in cities. Every populated continent has experienced new diseases, regardless of their economic status. Dengue is an excellent case in point. Prior to 1970, epidemics were restricted to as few as nine countries. Now a generation later, over 55 countries see regular outbreaks, due largely to the rapid spread of the principal arthropod vector, *Aedes aegypti*.[3] Chikungunya virus swept through Indian Ocean communities in 2005 as a result of adaptation to transmission by *Aedes albopictus*.[4]

Rodents as major vectors have thrived at the expense of other species in regions where there has been substantial changes to the ecosystems, their numbers increasing even further under abnormal weather conditions. In general terms, these observations translate into a need for a better understanding of how viruses cross the species barrier. We now recognize that viruses have a diverse manner of mechanisms to circumvent host innate immune responses, to the extent that the stimulation of cytokines in a new species may in itself induce the appearance of receptor molecules.[5] A recent survey has shown that nearly 90 RNA viruses use known cellular receptors.[6]

Inadequate surveillance for disease emergence coupled with the lack of trained infectious disease specialists remain major problems in almost all parts of the world. Added to this, in the recent past, there has been an increasing separation between resources dealing with human and veterinary diseases. The lack of integration was most vividly shown during the 1999 outbreak of West Nile fever virus in the United States. Significant time was lost in associating the increase in neurological cases noticed by clinicians with the apparently unrelated abnormally high number of deaths among the bird collection of the Bronx Zoo and the increasing numbers of dead birds found on the sidewalks of New York City. In the not too distant past, veterinarians and agricultural specialists were trained in infectious disease control alongside their colleagues in human medicine. This is too frequently no longer the case. Yet the basic principles of sample taking and observation, critical analysis of serological data and the use of vaccines where available are the same.

It is the area of diagnostics where perhaps this dichotomy is most revealing. During the 2001 Foot and Mouth disease outbreak in the United Kingdom, prolonged delays were experienced in implementing local control orders owing to the use of diagnostic protocols that had remained essentially unchanged for many years. This is in marked contrast with the everyday situation in blood donation, for example, where many thousands of units are screened for viral pathogens, such as viral hepatitis B, C and HIV, all in a matter of minutes. More needs to be invested in veterinary diagnostics, especially by government agencies, as the commercial returns from the sale of veterinary diagnostic assays are rarely attractive to manufacturers in the private sector.

Finally, any enhancement in the global capacity to recognize and react to infectious disease emergence is predicated on the training of the next generation of microbiologists in the principles of infectious disease control. This training needs to be focused on asking the right questions when faced with the unusual, no matter whether it is from the clinical caseload, livestock or wild animals. The next generation of disease specialists needs to be acquainted not only with the power of molecular technology but also equipped to understand disease pathogenesis and the basic principles underlying disease control. There is the added difficulty in that the availability of microbiologists with experience of handling category 4 pathogens, such as Lassa fever,

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Ebola and Rift Valley fever viruses, is now universally restricted to specialists close to, or beyond, retirement. Prolonged procrastination by governments over the retention or development of containment facilities has exacerbated the problem, hindering the long-term global capacity to react effectively to infectious disease emergence.

Despite these reservations, the resurgence of comparative medicine is underway in a number of key areas. For example, a number of US agencies are developing the 'One Health Initiative' (http://www.one-healthcommission.org) in order to promote interdisciplinary collaboration and communication in all aspects of health care. This initiative acknowledges not only the importance of integrated training programmes for medical and veterinary professionals, but also the need to embrace those elements of environmental science that will have a direct impact on epizootics and disease emergence through climate change.

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