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INVITED EDITORIAL

The future of viral infections

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Since the onset of the COVID-19 pandemic there is increasing scientific interest in animal viruses and their future cross-species transmission potential.

Although viruses are the most diverse and abundant of living organisms, we know less about their diversity, evolution, and cross-species transmission potential than other living organisms.[1]

Few animal species, mainly those located in the phylum Chordata have been surveyed for viruses, while surveillance among invertebrate species has mainly focussed on common disease vectors such as ticks and mosquitoes, both located in the phylum arthropoda, one of 21 invertebrate phyla. The recent advent of metagenomic next-generation sequencing has however begun to advance the study of the animal virome, revealing novel biodiversity insights. For example, while bats and rodents have been shown to harbour a wide range of coronaviruses, recent molecular explorations have documented coronaviruses in other vertebrates such as amphibians and fish.[1]

Large scale molecular studies, a feature of the scientific output arising from the current COVID-19 pandemic, have provided important information about the evolutionary trajectory of SARS-CoV-2.

Despite having descended from a bat coronavirus, SARS-CoV-2 was immediately successful in humans because of efficient human-to-human transmission. The virus has started to adapt to its host through the evolution of a series of distinct variants capable of more efficient human-to-human transmission. The recently emergent Omicron variant provides possible clues to the future relationship of SARS-CoV-2 and its human host, being highly transmissible, exhibiting immune escape with loss of neutralisation activity when exposed to plasma from vaccinated individuals, and causing less severe disease than prior variants.[2]

It is estimated that approximately 10,000 viruses circulating in wild mammals have the capacity to infect humans. Zoonotic spill-over is predicted to increase substantially during the next 50 years. Robust quantitative modelling suggests that climate and land use changes caused by global warning will bring humans and wild mammals into closer proximity particularly in areas of high population density, creating many opportunities for cross-species virus transmission. However, it is unclear how this will influence human health.[3]

The response to the COVID-19 pandemic provides important lessons for future outbreak and pandemic preparedness. The rapid development of diagnostics, therapeutics, and vaccines, as well as epidemiological insights contributed substantially to the global response to the COVID-19 pandemic. The management of future outbreaks and pandemics will undoubtedly rely on contributions of the scientific community. However, the COVID-19 pandemic also taught us that resilient health systems, overcoming global and in-country inequities, community engagement and participation, robust social safety nets, and attention to communication, misinformation, community mistrust and scepticism, pandemic fatigue and mental health, and bioethics are important considerations.[4]

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