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Editorial overview: Viruses in a changing world

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For a complete overview see the [Issue](#)

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We live in a time of high interconnectivity amongst populations and environments. Our dynamic global relations introduce abundant opportunity for viral pathogens to emerge and rapidly spread. These include global transportation, climate change, vaccine coverage, close living quarters with diverse animal species and antimicrobial resistance. Yet, on the other hand, there has been extensive progress in the understanding and treatments of infectious disease. For example, the recent introduction of rotavirus vaccines and HCV inhibitors have been transformative. Moreover, our improved mechanistic comprehension of viral evolution and host immune response to infection has facilitated novel therapeutic approaches and research technologies to control viral infections. In this special section of ‘Current Opinion in Virology’, we have gathered a collection of reviews all inspired by viruses in a changing world.

In recent years, multiple viruses have emerged or re-emerged to become significant global threats to human health. Most recently a novel coronavirus, SARS-CoV-2, emerged in Wuhan China at the end of 2019. SARS-CoV-2 is the third coronavirus to emerge and cause deadly illness in humans in a mere two decades. Despite extensive measures taken to limit the outbreak, SARS-CoV-2 has already spread globally as of early 2020. A very timely review by [Tim P. Sheahan](#) and [Matthew Frieman](#) provide a historical context of emerging coronaviruses with a special emphasis on the current SARS-CoV-2 spread into humans.

Not long before the SARS-CoV-2 outbreak, was the international emergence of Zika virus into the Americas in 2015. The rapid geographic spread of Zika to regions of the world with large susceptible populations led to a large-scale epidemic that brought recognition to rare, but severe, disease complications associated with infection (especially in pregnant women). True estimates of Zika virus burden are complicated by the fact that most infections are asymptomatic. Yet, what remains clear is that Zika virus infection rates in the Americas have declined almost as quickly as they rose—prompting questions as to the future course of this pathogen. In this special section, [Guilherme S. Ribeiro](#), [Gabriel Hamer](#), [Mawlouth Diallo](#), [Uriel Kitron](#), [Albert Ko](#) and [Scott Weaver](#) provide a response with a thorough review of enzootic arbovirus cycles and the effects of herd immunity on flavivirus transmission.

Zika virus is not the only flavivirus that has emerged. A case study on Dengue virus emergence in the Southern cone of South America recently implicated climate change in viral expansion into this region. A review by

Michael A. Robert, Anna M. Stewart-Ibarra, and Elizabeth L. Estallo discuss how climate change has led to global temperature changes that have contributed to the spread of the vectors, leading to emergence of mosquito-borne arboviruses.

The discovery of segmented flaviviruses in 2014 transformed our understanding of the genomic structure and organization of the Flaviviridae family. Since then several segmented flaviviruses have been described, but their relevance to human health remained unclear. In 2019, a novel member of the segmented flaviviruses, Alongshan virus, was isolated from a patient who presented with febrile illness. The segmented nature of Alongshan virus, together with its ability to infect multiple arthropod vectors amongst other animal species, make for interesting consideration when evaluating viral emergence as Xu Zhang, Nina Wang, Zedong Wang and Quan Liu discuss in their contributing article.

Defining etiological agents of disease are not always as straightforward as was found with Alongshan virus and this has indeed been the case for conclusively defining the causative agent of the recent outbreaks of ‘polio-like’ limb paralysis in children, designated acute flaccid myelitis (AFM). Priyanka Uprety and Erin H. Graf describe the growing evidence that support a role for enterovirus infection in mediating AFM, especially enterovirus D68. Because of the poor prognosis associated with onset of AFM in otherwise healthy children and the perpetuation of predicted outbreaks to occur every two years, work is needed to ascertain prevention and/or therapeutic strategies.

As our understanding of infectious disease has improved, the therapeutic strategies to battle viral infections have evolved. For example, the mechanistic understanding of how our immune system reacts to chronic infection has

aided the development of strategies to strengthen and/or reinvigorate the immune system to battle virus replication. Erin S. Beck and Irene Cortese describe the recent finding that blockade of immune checkpoint inhibitors (originally developed for cancer treatment) may be an effective therapy for the otherwise fatal JC polyomavirus-caused progressive multifocal leukoencephalopathy (PML).

Given the amount of progress and the complexity of approaches involved in the development of a universal influenza vaccine, initiatives has been made to compile various investigational strategies and outcomes. Julie Ostrowsky, Meredith Arpey, Kristine Moore, Michael Osterholm, Martin Friede, Jennifer Gordon, Deborah Higgins, Julia Molto-Lopez, Jonathan Seals and Joseph Bresee describe ‘The Universal Influenza Vaccine Technology Landscape’ which is a new effort to publicly track and report the global development of universal influenza vaccine technologies. The hope is to create space for more collaborative, transparent and mission-driven progress toward an effective universal influenza vaccine.

Despite our extensive progress to prevent viral diseases through the development of effective vaccines, we are experiencing a global resurgence of vaccine-preventable diseases. Luojun Yang Bryan T. Grenfell and Michael J. Mina discuss the consequences of vaccine hesitancy and refusal on the re-emergence of preventable infectious disease, but also the compounding impact of waning immunity. This enigmatic situation of society rejecting available preventative measures as a means for viral re-emergence emphasizes the ever increasing need to gain the public’s confidence in science.

In conclusion, in this special section we have put together a group of reviews demonstrative that as our world is changing, viruses are also adapting and following suit.