

INTRODUCTION

Dear readers,

Current experience connected with the pandemic of the SARS-CoV-2 coronavirus has raised virology to the forefront of the biomedical research. It has become clear that the knowledge on newly emerging or re-emerging viruses, understanding of their molecular, pathogenic and epidemiological characteristics and ability to rapidly react to their spreading by proper preventive, diagnostic and therapeutic measures is key to ensure our preparedness for the future outbreaks. This special issue of *Acta virologica* contributes to this knowledge by a small fragment in the form of review articles dedicated to diverse aspects of virus research.

Thousands of papers related to SARS-CoV-2 virus and/or COVID-19 disease have been published or submitted to open repositories worldwide during the past few months. Despite this overwhelming amount of information resources, diversity of topics and expert opinions, our knowledge in this area is still marginal. In this special issue of *Acta virologica*, we provide four papers dedicated to coronavirus research. Brief introduction into understanding of coronavirus ecology and outbreaks (Rajčáni, 2020) is followed by an overview of the history, epidemiology, and clinical attributes of COVID-19 reported in recently published studies (Cao *et al.*, 2020). Based on SARS-CoV-2 genomic data and a model of the host-virus interaction, the authors propose several possible targets for antiviral drugs. The next article provides more specific insight into a case of encephalitis caused by a conventional human HKU1 coronavirus, which is usually associated with common cold (Cao *et al.*, 2020). This is actually the first observation of neurotropism for HKU1 coronavirus. The fourth coronavirus-related article summarizes recent advances in vaccines and diagnostics against Middle East respiratory syndrome coronavirus, which caused the MERS epidemic in 2012 (Lee and Nam, 2020). This information can be very useful in light of recent developments in SARS-CoV-2 pandemics.

However, coronaviruses are not the only zoonotic viruses able to cause epidemics/pandemics. Human population is continuously exposed to potential outbreaks of other viruses present in nature in their animal hosts or

vectors. With urbanization, industrialization and climate changes, humans are more and more frequently coming into direct and uncontrolled contacts with infected animals. This creates both evolutionary pressures for virus adaptation to new conditions and opportunities for accidental transmissions, eventually leading to crossing host barriers. Subsequent transmission of the virus infection among humans is a rare event, but when it happens, it can cause unexpected damages to health and economy. Increasing population density, heavy transport over long distances, and close social contacts can then support virus spreading. Out of viruses, which represent potential danger to humans, this special issue of *Acta virologica* depicts West Nile virus, Rabies virus and Tick-borne encephalitis virus. West Nile virus (WNV), a flavivirus infecting vertebrate hosts including humans, represents a medical and veterinary public health concern due to climate-related increased abundance of its mosquito vectors. Comprehensive overview of WNV characteristics and its history in Slovakia (Korytár *et al.*, 2020) emphasizes an urgent need of a countrywide surveillance program aimed at the WNV occurrence in vectors and reservoirs. On the contrary, epizootic situation in rabies in Slovakia is very favorable as Slovakia is presently a rabies-free country. However, historical survey (Ondrejková *et al.*, 2020) illustrates that it was not true in the past and that prevention of wildlife rabies by vaccination of red foxes was necessary to achieve effective control of the virus. In case of Tick-borne encephalitis virus (TBEV), main reservoir hosts are ticks, rodents and insectivores, but domestic animals may also be infected with this virus. The review published in the present issue of *Acta virologica* describes how infection manifests in dogs and horses, with symptoms similar to severe human cases, in comparison to ruminants, which are usually asymptomatic and represent risk to human health (Salat and Ruzek, 2020). Authors describe recently developed experimental veterinary vaccine and propose vaccination as a prevention of TBEV transmission from domestic animals to humans.

In addition to mechanisms and routes of the host-to-host or vector-to-host transmission, it is important to uncover mechanisms of virus pathogenesis. This area of virus research requires deep understanding of molecular

pathways involved in virus multiplication, physiological processes in infected cells, modes of cell-to-cell transport of virus particles and principles of immune responses. Suitable *in vivo* models are needed to recapitulate pathogenic mechanisms at the level of living organism. Papers published in this special issue of *Acta virologica* touch some of these aspects of the virus research. Cell-to-cell spread of diverse viruses can occur not only via classical receptor-mediated route, but also via different types of membrane projections and/or intercellular connections facilitating avoidance of virus exposure to immune system (Labudova *et al.*, 2020). During replication, viruses exploit infected cells and reprogram their metabolism towards production of energy and biosynthetic precursors for the components of the progeny virions. Review related to this topic describes virus-induced metabolic alterations in host cells and proposes that pharmacological inhibition of specific metabolic pathways can represent promising antiviral approach (Polcicova *et al.*, 2020). The fate of virus infection within the host organism strongly depends on elicited immune response, in which T cell-mediated immunity plays a key role. The paper of Beňová *et al.* (2020) discusses the protective and pathological roles of diverse subsets of T cells in response to infections caused by certain human viruses and explains that a gentle balance of effector responses clearing the infected cells and regulatory mechanism preventing immunopathology is needed for optimal immune responses to viral infections. Studies aimed at understanding virus pathogenesis at the level of organism require proper virus and host models *in vivo*. This special issue of *Acta virologica* includes two articles describing murine herpesvirus 4 (MHV-4) as a model for research of human oncogenic gammaherpesviruses (Mistríková and Briestenská, 2020) and mice as experimental models for studying coxsackieviruses (Bopegamage *et al.*, 2020).

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Understanding molecular details of regulatory and/or structural proteins encoded by viruses are also of high importance as these proteins can affect the course of virus infections at various critical steps. For example, herpesviruses encode chemokine-binding proteins that allow for evasion of the immune defence mechanisms mediated by network of host immunomodulatory molecules, as discussed by Benko *et al.* (2020). These viral chemokines can on one hand facilitate virus infection, but on the other one can be also viewed as potential anti-inflammatory or immunomodulatory drugs. In human cytomegalovirus (HCMV), which causes largely asymptomatic infection in healthy individuals, but can become severe when immunity is compromised, UL/b' region appears to play a major role in manipulating host immune response (Kempová *et al.*, 2020). This region, encoding up to 22 canonical genes, is usually lost in laboratory virus strains, as they are not exposed to immune system. The authors review how HCMV shapes host immunity by hijacked genes originating from UL/b' locus, discuss their role in immunomodulatory mechanism and propose how this knowledge may translate to clinical applications. Virus life cycle and pathogenesis can be also influenced by posttranslational modifications of the viral proteins through the effects on protein-protein interactions. This is discussed with respect to hepatitis B virus, which can cause chronic hepatitis, liver failure, cirrhosis or even carcinoma (Lubyová and Weber, 2020).

In summary, this special issue of *Acta virologica* offers interesting insights into molecular biology, pathogenesis, immunology and ecology of viruses that can infect humans and/or animals and represent potential risk for health. Hopefully, readers will find the included articles as good resources of comprehensive, timely and reliable information and/or inspiration for their future research.

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REMARK

This special issue did not undergo a reviewing process typical for *Acta virologica* and was subjected just to formatting and editing (with the exception of the articles on coronavirus). Therefore the Editor-in-Chief of *Acta virologica* does not take responsibility for the scientific content of this issue.