COVID-19 research: Human-Animal Interface

Increasing risks at the human-animal interface: Research needs for risk reduction and prevention

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Global Research and Innovation Forum
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World Health Organization

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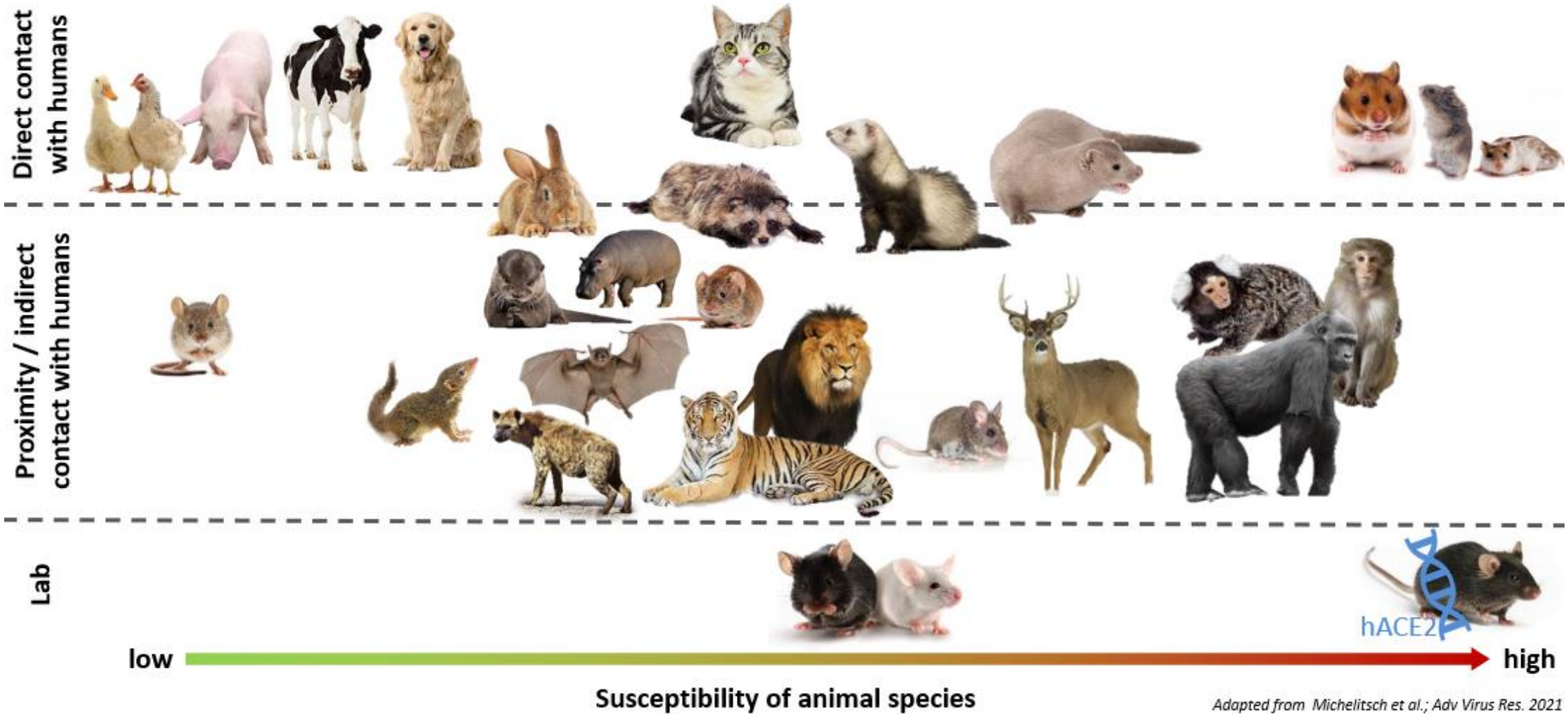
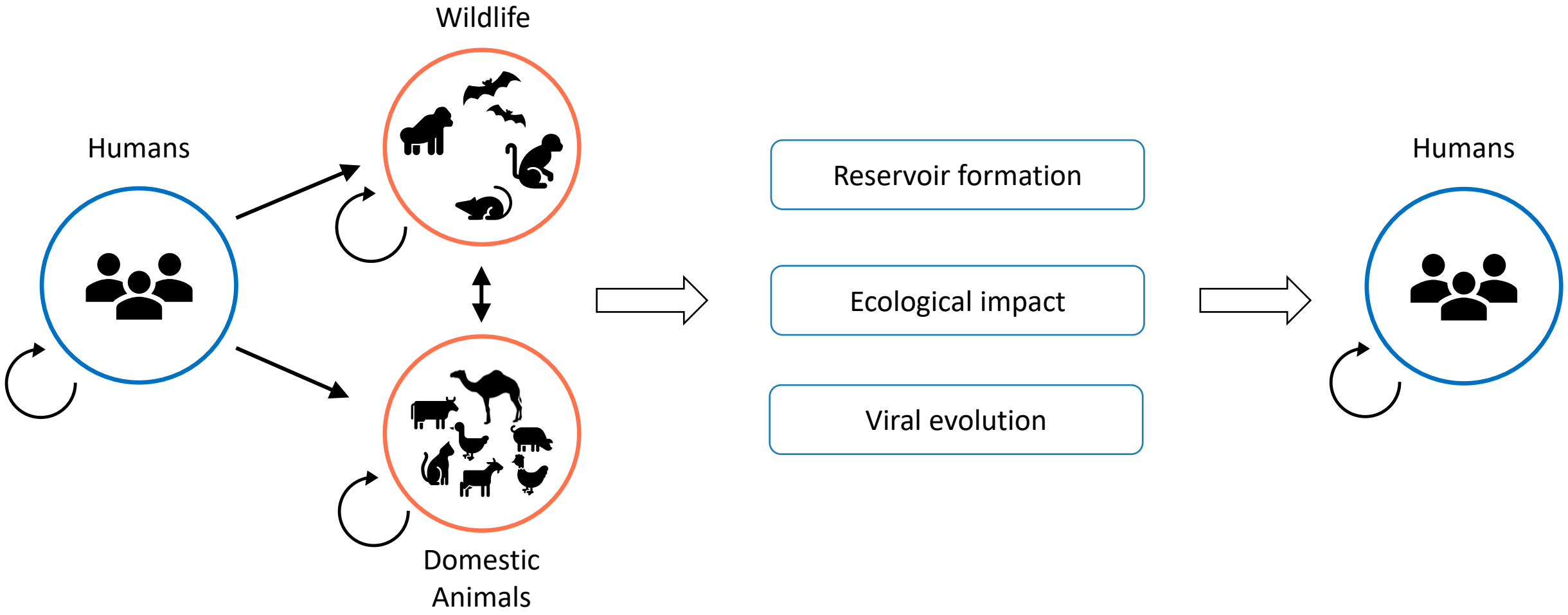
SARS-CoV-2 infections in animals



Adapted from Michelitsch et al.; Adv Virus Res. 2021

SARS-CoV-2 infections in animals: The risks



Research results – Key achievements

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Research results

Animal infections

- Initial assessment of the susceptibility of multiple animal species
- Validation of diagnostic tools for animal samples
- Initial sampling in some animal populations
- Detection of first reverse transmission events

Virus evolution

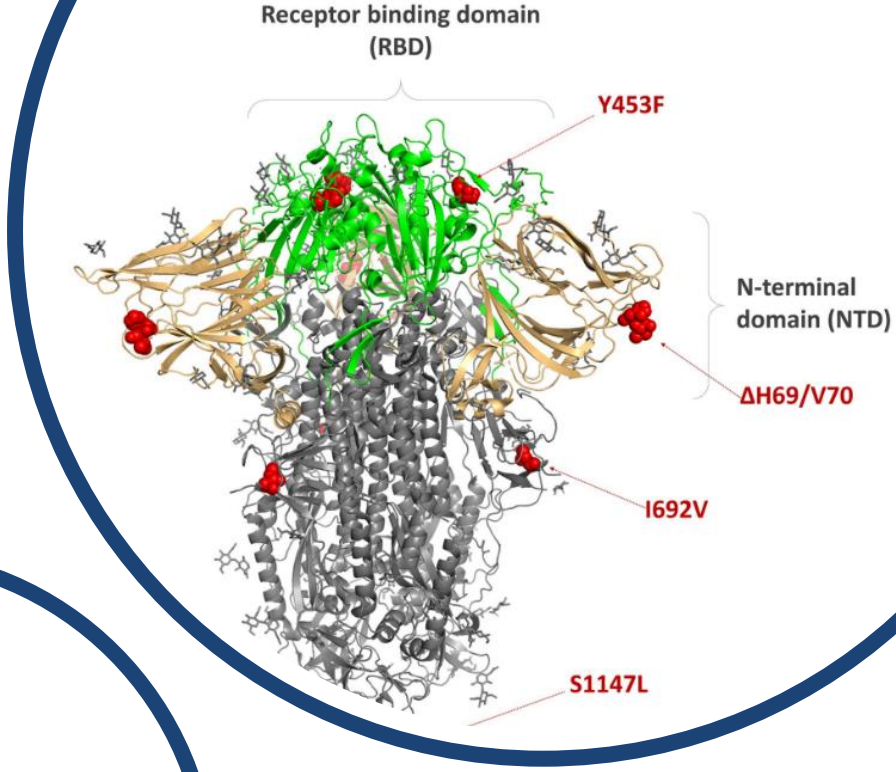
- Genetic sequencing in few animals enabled initials analysis of viral evolution in animal hosts.
- The investigation of the outbreak in farmed minks informed risk assessment at the global level resulting in development of biosafety guidance.

Food chain

- Studies on transmission along the food chain
- Evaluation of virus persistence and infectivity during food processing and quantification in water and food matrices
- Guidance for competent food authorities

Lessons learned

- Several species in the proximity of humans are susceptible to SARS-CoV-2 and have potential to form virus reservoirs - especially in farms or other spaces where larger groups of animals reside in close proximity
- Novel animal hosts have the potential to drive virus evolution
- Reverse spillover from animal to human has been observed in two instances to date
- There is an urgent need to increase surveillance in risk species, as well as sequencing to identify the formation of reservoirs early and to monitor viral evolution



Priority research to be better prepared for future pandemics

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Research priorities

Identification of coronavirus related to SARS-CoV-2 in potential hotspots of emergence

Key question:

➔ Which are the **coronaviruses of possible public health interest** circulating in areas known to be prone to the emergence of these viruses?

Retrospective testing of **archived samples** of susceptible wild and domestic animals in Southeast Asia and China and in countries with evidence for SARS-CoV-2 related virus

Identification and characterization of **coronaviruses related to SARS-CoV-2** in farmed, captive, and free-living animal species in potential hotspots of emergence

Identification and characterization of **coronaviruses related to SARS-CoV-2 in environment** related to farm or animal roost, and animal (non-commercial) products such as guano or manure

Research priorities

Susceptibility studies in animals

Key questions:

- **What species are susceptible** to SARS-CoV-2 and can transmit the virus to animals and/or humans?
- What are the **determinants of SARS-CoV-2 susceptibility** in animals?
- What are the **determinants of SARS-CoV-2 transmission** from different animal species to other susceptible hosts including humans?

Susceptibility studies with the most prevailing SARS-CoV-2 lineages in humans

Characterisation of **infectivity; pathogenicity, transmissibility** in susceptible species

in-vitro studies of **receptor binding & expression patterns of host proteins**

Research priorities

Surveillance in animal populations

Key questions:

- What is **the prevalence and** what are the **epidemiological consequences of SARS-CoV-2 infections** in farmed, captive, and free-living animal species?
- What animal species have, or could become a **SARS-CoV-2 maintenance or reservoir host**?

Targeted **SARS-CoV-2 surveillance** in observed or predicted susceptible species or other animals knows to be susceptible to SARS-CoV-2 related viruses with inter-species transmission

Mapping the **(seasonal) prevalence of other coronaviruses** and possible impact on the course of the infection in animals

Understanding of **animal ecology and behaviors** related to virus infection and spillover

Research priorities

Virus evolution predictions in susceptible species

Key question:

➔ How might we **predict and detect novel SARS-CoV-2 variants** or recombination of CoVs which have a spillover risk to humans and/or animals

In silico **predictions of potential mutations** of SARS-CoV-2 and potential implications following re-introduction to humans

Natural infection and *in vitro* studies on recombination/gene transfer potential during **co-infections with other CoVs/viruses** of interest

Experimental *in vivo* and *in vitro* infection studies in susceptible species **following** the **mutation rate over the course of infection and its drivers**

Research priorities

Risks linked to trade and consumption of potentially infected animal species

Key questions:

- What are the **risks linked to trade and consumption** of potentially infected animal species?
- What are the **communities or occupational groups more at risk** across different interfaces?

Better understanding of the dynamics around **(legal & illegal) wildlife capture, breeding, transport, and trading**, and current prevention strategies

Analysis of **behavioural and organisational risks** along the wild and domestic animal value chain

Determination of optimal **strategies to manage infection risks** of wild animal farming and to stop illegal transportation and trading of captured animals

Next steps

Use the Tripartite+ (WHO, FAO, OIE, UNEP) collaboration and support from SAGO and OHHLEP to:

- support expert exchanges through existing working groups and ad hoc meetings gathering the main partners and preeminent experts
- coordinate the identification of research priorities
- promote and advocate for the resulting research agenda since research in animals is often underfunded
- optimize possible funding toward research priorities and direct support to poorly investigated countries / animal species, as relevant.

Thankyou

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