



PATHOLOGY MATTERS

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**An Open Question in the COVID-19 Pandemic: Can
Humans Transmit the Disease to Pets and
Vice Versa?**

SARS-CoV-2 infection apparently emerged in China in December 2019, causing the disease known as COVID-19, which can cause severe damage to vital organs (Ackermann *et al.*, 2020). Spillover of SARS-CoV-2 from bats to humans has been hypothesized (Ackermann *et al.*, 2020). The virus spike protein is the main determinant of viral tropism because it is responsible for binding to the angiotensin converting enzyme 2 (ACE2) and subsequent entry of SARS-CoV-2 to host cells in humans and several animal species (Sun *et al.*, 2020). Therefore, it is reasonable to hypothesize that the spike protein–ACE2 receptor complex may represent evolutionary exploitation to overcome species barriers to infection, thus highlighting the zoonotic origin and transmission of the virus.

SARS-CoV-2 infection mainly affects the human respiratory system following airborne transmission. The virus has also been detected in pet animals, perhaps due to their proximity to humans in the home environment, and particularly in regions of the world with higher rates of spread of this coronavirus among humans (de Moraes *et al.*, 2020). Therefore, it appears likely that pets may have received SARS-CoV-2 from their owners by airborne transmission. Other animals within the human environment, such as farmed mink, have also been reported to have been infected with SARS-CoV-2 (Shi *et al.*, 2020). A genomic sequencing study of mink and mink farm workers concluded that SARS-CoV-2 was initially introduced by humans and subsequently genetically evolved, resulting in widespread circulation among

mink (Oude Munnink *et al.*, 2021). Interestingly, this study showed that some workers had become infected with SARS-CoV-2 variants with an animal sequence signature, which provides potential evidence of animal-to-human transmission of SARS-CoV-2 on mink farms.

It seems reasonable to speculate that the infection of new animal species with SARS-CoV-2 represents an opportunity for this coronavirus to mutate in the novel host. Probably, when the animal population density is high, SARS-CoV-2 could evolve rapidly and even spread from animals to humans. Since intra- and trans-species spread of SARS-CoV-2 appears likely, animal infection should be considered of epidemiological significance in the control of the COVID-19 pandemic (de Moraes *et al.*, 2020; Sun *et al.*, 2020).

Humans are more likely to infect, or become infected by other humans, due to their lifestyle habits. Hence, humans may carry SARS-CoV-2 into the home environment and infect their pets. On the contrary, it appears likely that pets very rarely spread SARS-CoV-2 to other animals, because they usually do not live in communities and therefore lack the opportunities for spreading the virus that humans have (eg, work, school, university, shopping, cinema and other social environments). However, companion animals can become infected by their owners. Although it can be reasonably hypothesized that the risk of SARS-CoV-2 transmission from domestic animals to humans is very low or rare, it is essential to consider such a possibility in order to adopt the most

appropriate epidemiological and preventive approaches, and to understand the infectivity profile of owners in terms of SARS-CoV-2 variants.

Therefore, testing of symptomatic and asymptomatic pets living in proximity to social or work environments, where human COVID-19 cases have been identified, could be a rational preventive practice.

While waiting to understand the actual extent of potential transmission of SARS-CoV-2 between pets and humans, we should plan to protect companion animals from SARS-CoV-2 infection. In this context, consideration should be given to designing effective animal vaccines, since a global herd immunity for all susceptible domestic animal species will presumably be important to minimize trans-species transmission.

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