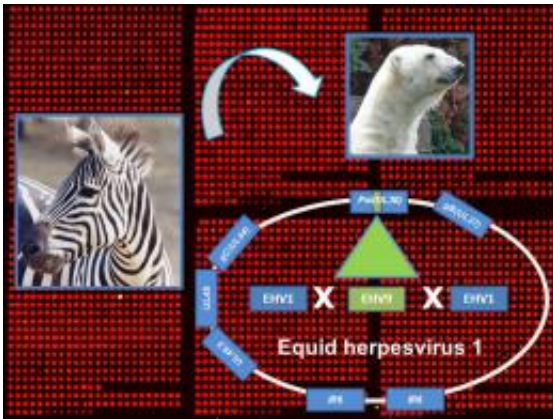


Viruses jumping species and zoo polar bear disease

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Model for the recombination and transmission of zebra derived Equine herpesvirus 1 to polar bears. Grafic: IZW/Zoo Wuppertal

Zoos bring together different animal species that would never encounter each other in the wild. On occasion, this can have unforeseen consequences. When in 2010 at the Wuppertal Zoo one polar bear died and another fell severely ill, zoo veterinarians were at a loss as to the cause of the symptoms. It has now been shown that the bears were infected with a recombinant zebra-derived virus that had jumped into other species, as reported today by an international team of researchers led by the Leibniz Institute for Zoo and Wildlife Research in the journal *Current Biology*. Such species-jumping viruses, if not detected, may threaten the conservation mission of zoos.

Keeping animals from around the world is an important component of the mission of zoos to educate the public and preserve [endangered species](#). To date, it has rarely been considered that such a [species](#) mix may have unpredictable consequences in terms of transfer of pathogens among zoo animals. Generally, pathogens adapt to a specific host, but some are opportunistic and can spread to new hosts upon encounter.

The study by researchers from the Leibniz Institute for Zoo and Wildlife Research Berlin (IZW), the Freie Universität Berlin, the University of Sydney and the Zoological Gardens Wuppertal reports such a case of a virus jumping from one species to another. In 2010 at the Wuppertal Zoo in Germany, a female polar bear, Jerka, died of encephalitis despite the best efforts of the zoo veterinarians to save her. Her male companion Lars exhibited similar symptoms but survived as a result of intervention and long-term veterinary care. Dr. Arne Lawrenz, zoo veterinarian in Wuppertal, describes the situation: "The symptoms were quite shocking, and it was completely unclear at the time what was causing them. We tried to stabilize both animals for days. In the case of Jerka, we were sadly unsuccessful. Fortunately, however, Lars recovered after several weeks and is still alive today."

Encephalitis can be caused by a large number of [viruses](#) and bacteria, and identifying novel pathogens in wild animals is a huge, often insurmountable, challenge. However, the intensive investigation of Jerka, Lars and nine additional polar bears yielded a zebra-derived herpes virus as the only candidate pathogen. A surprising find was that polar bear Struppo, which died years earlier from renal failure in a different zoo with no contact to Jerka or Lars, was also positive for the virus. This indicates that this virus has jumped independently before and may continue to do so.

Interestingly, the virus turned out to be a recombinant, i.e. a combination of the genetic material of two different viruses both found in zebras. It

originated when the Equine herpesvirus EHV9 transferred a portion of its DNA into the related EHV1. While recombination is not uncommon for herpesviruses, the gene region transferred in this case is notable for its role in causing neurological diseases even in horses. Whether this novel virus emerged recently in the zoo [zebra](#) population or a long time ago in Africa, and whether the recombination event is responsible for the ability of the virus to jump to new hosts and cause deadly disease are open questions.

"When we started, there was an overwhelming number of potential pathogens that might have caused Jerka's death", illustrates Prof. Alex Greenwood of the IZW, lead author of the study. "At first it seemed easy, because we quickly got a signal for EHV. But when we looked at the viral DNA sequence, it could have been either EHV1 or EHV9. With more sequence data it became clear that there was one gene that was partly like one virus and partly like the other."

Another open question is how the bears were infected. Polar bears in Wuppertal are not cared for by the same zookeepers as zebras. In addition, the zebras are housed 68 meters away, thus direct contact is unlikely to be the route of transmission. However, [bears](#) and zebras are not the only hosts, as the parent viruses were associated with fatal encephalitis in other zoo species such as gazelles and guinea pigs. Prof. Klaus Osterrieder from the Freie Universität Berlin explains: "These viruses do not seem to respect species boundaries and in fact, we don't really know whether they have any. One conundrum is that these viruses are not particularly stable in the environment, so it is important to figure out how they move between species." The authors of the study are currently exploring the possibility that transmission could even occur through wild mice or rats.

Being alert to the possibility of pathogen species jumps and their potentially fatal consequences, zoos can serve as sentinels for disease

outbreaks and protect their animals. However, this important task will be complex, as pathogens may cause no symptoms in some species or individuals and unexplained mortality in others. For most of the many [pathogens](#) that can cause encephalitis or fatality, not much is known about their ability to enter new host species. Further wildlife disease research, better communication between institutions and careful monitoring will be required to ensure the success of the conservation mission of zoos. At least one case has been successfully resolved though, says Dr. Arne Lawrenz of Wuppertal [Zoo](#): "With our colleagues we have screened our [polar bears](#) in Wuppertal to make sure they are EHV-free, and we will do so on a regular basis. Now that we are aware of this issue, we are better prepared and can be proactive."

More information: Greenwood AD, Tsangaras K, Ho SYW, Szentiks CA, Nikolin VM, Ma G, Damiani A, East ML, Lawrenz A, Hofer H, Osterrieder N, A potentially fatal mix of herpes in zoos. *Current Biology*, (2012), [dx.doi.org/10.1016/j.cub.2012.07.035](https://doi.org/10.1016/j.cub.2012.07.035)

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