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New coronavirus has many potential hosts, could pass from animals to humans repeatedly

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The SARS epidemic of 2002-2003 was short-lived, but a novel type of human coronavirus that is alarming public health authorities can infect cells from humans and bats alike, a fact that could make the animals a continuing source of infection, according to a study to be published in in *mBio*, the online open-access journal of the American Society for Microbiology, on December 11.

The new coronavirus, called hCoV-EMC, is blamed for five deaths and several other cases of severe disease originating in countries in the Middle East. According to the new results, hCoV-EMC uses a different receptor in the human body than the SARS virus, and can infect cells from a wide range of bat species and pigs, indicating there may be little to keep the virus from passing from animals to humans over and over again.

First identified in a patient in Saudi Arabia in June, nine laboratory-confirmed cases of hCoV-EMC infection have now been identified, five of whom have died. Although the virus does not apparently pass from person-to-person very readily, the case fatality rate and the fact that the source of the virus has not been identified have caused concern among global public health authorities. Cases of hCoV-EMC infection are marked by severe pneumonia and often by kidney failure.

"This virus is closely related to the SARS virus, and looking at the

clinical picture, it causes the same pattern of disease," says Christian Drosten of the University of Bonn Medical Centre in German, a lead author of the study.

Given the similarities, Drosten and his colleagues wanted to know whether hCoV-EMC and SARS might use the same receptor, a sort of molecular "dock" on human cells that the virus latches onto to gain entry to the cell. The SARS receptor, called ACE2, is found mostly on pneumocytes deep within the human lung, so an individual must breathe in many, many SARS viruses for a sufficient number of them to reach this susceptible area and cause an infection. Drosten says this simple fact helped ensure the SARS outbreak didn't spread like wildfire and was mostly limited to healthcare workers and residents of overcrowded housing in Hong Kong. Also, once a person was infected with SARS in the deep part of their lungs, he or she felt sick almost immediately and therefore was not active in the community and infecting others, another aspect of the receptor that helped curb the outbreak.

Does hCoV-EMC use the same receptor? If so, the means of controlling this new virus might become clearer.

"The answer is a clear no," says Drosten. "This virus does not use ACE2." This leaves open the possiblity that hCoV-EMC could use a receptor in the human lung that is easier to access and could make the virus more infectious than SARS, but it is still not known what receptor the virus does use.

To help identify how hCoV-EMC might have originated and moved between humans and animals, the second part of the study focused on the animal species the virus can infect. SARS is closely related to viruses from bats, but Drosten says the virus changed in the transition from bats to civet cats to humans and could no longer infect bats, so SARS was not present in the wild and did not pass repeatedly from bats to humans like

a classical zoonotic disease. "So the [SARS] virus lost its old host and gained a new one," says Drosten.

Like SARS, hCoV-EMC is most closely related to coronaviruses from bats, but unlike SARS, this study found that hCoV-EMC can still infect cells from many different species of bats. "This was a big surprise," says Drosten. "It's completely unusual for any coronavirus to be able to do that – to go back to its original reservoir." The virus is also able to infect cells from pigs, indicating that it uses a receptor structure that all these animals have in common. If that receptor is present in mucosal surfaces, like the lining of the lung, it is possible the virus could pass from animals to humans and back again, making animals an ongoing source of the virus that would be difficult or impossible to eliminate.

Drosten says work on hCoV-EMC will continue in many hospitals and laboratories. His own lab will continue the search for the hCoV-EMC receptor and will work on developing diagnostic tools to help identify cases of infection with the virus.

Drosten says he's also driven to find the animal source of the virus, a crucial piece of information in managing a potential outbreak. The virus can infect bats with host ranges that extend all across Europe and into the Arabian Peninsula.

Provided by American Society for Microbiology