Medical Xpress

Study puts troubling traits of H7N9 avian flu virus on display

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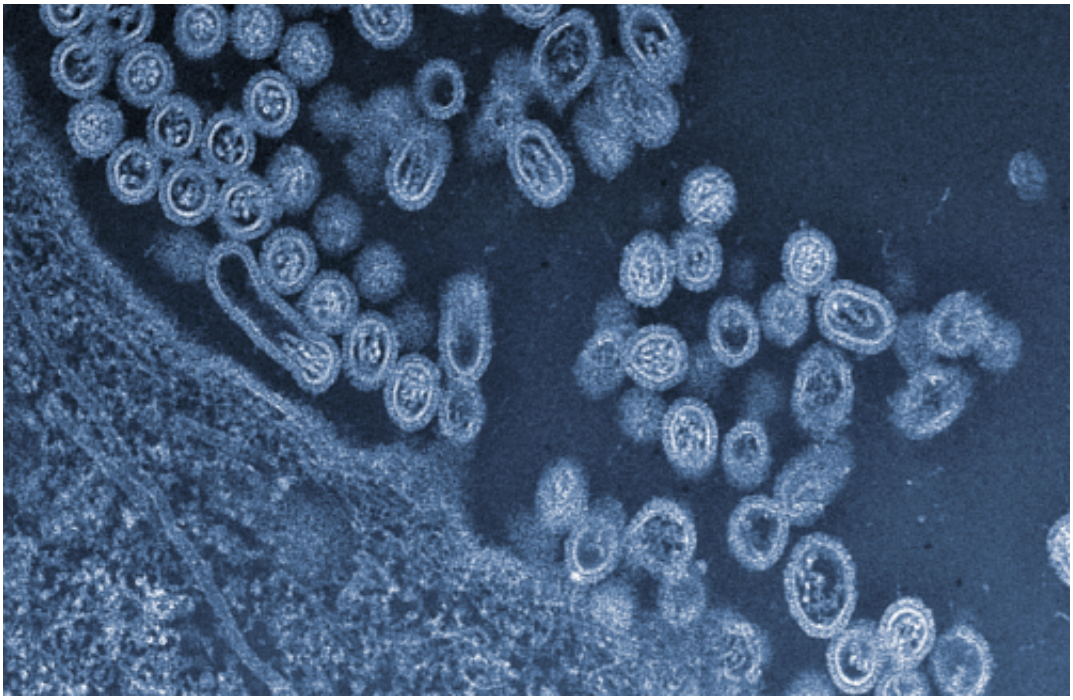

Infectious particles of the avian H7N9 virus emerge from a cell. The virus, according to a new report in the journal Nature by a team led by the University of Wisconsin-Madison's Yoshihiro Kawaoka, has qualities that make it a potential global human health threat. Credit: Courtesy of Takeshi Noda, University of Tokyo

The emerging H7N9 avian influenza virus responsible for at least 37 deaths in China has qualities that could potentially spark a global outbreak of flu, according to a new study published today (July 10,

2013) in the journal *Nature*.

An international team led by Yoshihiro Kawaoka of the University of Wisconsin-Madison and the University of Tokyo conducted a comprehensive analysis of two of the first human isolates of the virus from patients in China. Their efforts revealed the H7N9 virus's ability to infect and replicate in several species of mammals, including ferrets and monkeys, and to transmit in ferrets—data that suggests H7N9 viruses have the potential to become a worldwide threat to human health.

"H7N9 viruses have several features typically associated with human influenza viruses and therefore possess pandemic potential and need to be monitored closely," says Kawaoka, one of the world's leading experts on avian flu.

Normally, avian influenza viruses do not infect humans, with the exception of the highly pathogenic H5N1 strains. However, the H7N9 virus has so far infected at least 132 humans, killing more than 20 percent of those infected, and several instances of human-to-human infection are suspected.

The new study suggests that the ability of the H7N9 virus to infect and replicate in human cells may be due to just a few amino acid changes in the genetic sequence of the virus. "These two features are necessary, although not sufficient, to cause a pandemic," says Kawaoka, explaining that the influenza virus depends on host cells, which it hijacks to make new virus particles and sustain the chain of infection.

In monkeys, the H7N9 virus was shown to efficiently infect cells in both the upper and lower respiratory tract. Conventional human flu viruses are typically restricted to the upper airway of infected nonhuman primates.

"If H7N9 viruses acquire the ability to transmit efficiently from person to person, a worldwide outbreak is almost certain since humans lack protective immune responses to these types of viruses," according to Kawaoka.

Transmission studies conducted by Kawaoka's group in ferrets—animals that, like humans, infect one another through coughing and sneezing and that are a standard model for studies of influenza in mammals—showed that one of the H7N9 strains isolated from humans can transmit via respiratory droplets, though not as efficiently as human influenza viruses. The limited aerosol transmission observed in ferrets adds to concerns about the potential threat as avian flu viruses typically lack that ability, Kawaoka notes.

"H7N9 viruses combine several features of pandemic influenza viruses, that is their ability to bind to and replicate in human cells and the ability to transmit via respiratory droplets," Kawaoka says.

Complicating the H7N9 picture is the fact that the H7N9 virus does not kill poultry, which promises to make surveillance much more difficult. "We cannot simply watch out for sick or dead birds. Rather, tests have to be performed to determine whether or not a bird is infected. Considering the vast number of poultry, this is a daunting task."

The positive news conveyed in the new *Nature* report is that most of the H7N9 strains tested were somewhat sensitive to antiviral drugs effective against the seasonal flu virus, although one isolate, which appears to be a mix of two variants of the H7N9 virus, seemed to resist neuraminidase inhibitors like Tamiflu.

Further research is needed, Kawaoka argues, to support vaccine development, to assess the risks, and to better understand why the H7N9 viruses infect humans so efficiently.

More information: Characterization of H7N9 influenza A viruses isolated from humans, DOI: 10.1038/nature12392

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