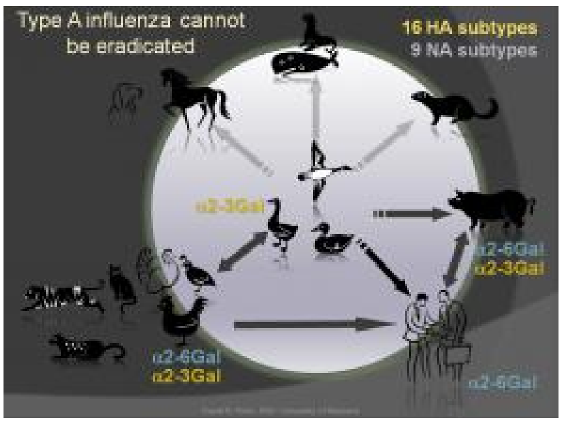
Avian Flu Research Sheds Light on Swine Flu Outbreak (w/Podcast)

April 28 2009, By Gwyneth Dickey



This graphic shows why the Type A virus can't be eradicated.

(PhysOrg.com) -- A new study by University of Maryland researchers suggests that the potential for an avian influenza virus to cause a human flu pandemic is greater than previously thought. Results also illustrate how the current swine flu outbreak likely came about.

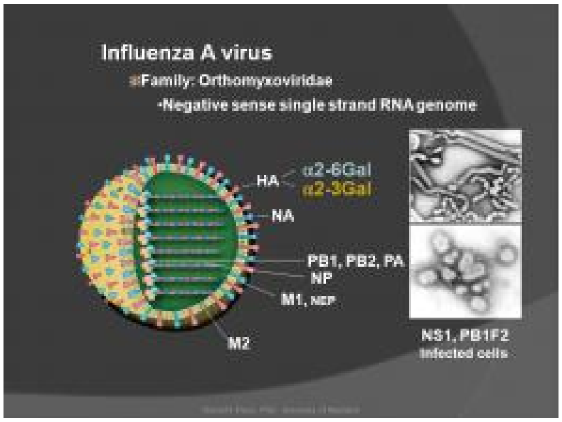
As of now, avian flu viruses can infect humans who have contact with birds, but these viruses tend not to transmit easily between humans. However, in research recently published in the Proceedings of the National Academy of Sciences, Associate Professor Daniel Perez from the University of Maryland showed that after reassortment with a human influenza virus, a process that usually takes place in intermediary species like pigs, an avian flu virus requires relatively few mutations to spread rapidly between mammals by respiratory droplets.

"This is similar to the method by which the current swine influenza strain likely formed," said Perez, program director of the University of Maryland-based Prevention and Control of Avian Influenza Coordinated Agricultural Project, AICAP. "The virus formed when avian, swine, and human-like viruses combined in a pig to make a new virus. After mutating to be able to spread by respiratory droplets and infect humans, it is now spreading between humans by sneezing and coughing."

In his study, Perez used the avian H9N2 influenza virus, one that is on the list of candidates for human pandemic potential. Using reverse genetics, a technique whereby individual genes from viruses are separated, selected, and put back together, Perez and his team created a hybrid human-avian virus. Their research hybrid has internal human flu genes and surface avian flu genes from the H9N2 virus. Though it comes from a different strain of avian flu than the one that contributed to the hybrid virus now causing the swine flu outbreak, Perez's research virus is similar in origin to the swine flu virus, in that both involved a combination of avian and human influenza viruses.

Perez infected ferrets (considered a good model for human influenza transmission) with the virus he created, and allowed the virus to mutate in the species. Before long, healthy ferrets that shared air space but not physical space with the infected ferret had the virus, showing that the virus had mutated to spread by respiratory droplets.

When the genetic sequences of the mutant virus and original hybrid virus were compared, the only differences were five amino acid mutations, three on the surface, and two internally. Two of the surface mutations were determined to be solely responsible for supporting respiratory droplet transmission. Because so few mutations were necessary to make the hybrid H9N2 transmissible this way, they concluded that after an animal-human hybrid influenza virus forms in nature, a human pandemic of this virus is potentially just a few mutations away.



The Influenza A Virus.

"We do not know if the mutations we saw in the lab are the same that have made the H1N1 swine flu transmissible by respiratory droplets," Perez said. "We will be doing more research on the current swine flu strain to study its specific genetic mutations."

Perez found that one of the two of the genetic mutations in his lab strain that enabled respiratory transmission between mammals was on the tip of the HA surface protein, one of the sites where human antibodies created in response to current vaccines would bind.

"Because the binding site of the mutant virus is different from the virus upon which the vaccine is modeled, it may mean that current vaccine stocks would not be as effective against the H9N2 mutant strain as previously anticipated," said Perez. "We should keep this in mind when designing vaccines for an avian flu pandemic in humans."

However, scientists cannot predict what the actual mutations will look like if and when they occur in nature, or even which strain of avian influenza will mutate to infect mammals.

"This is just the tip of the iceberg," said Perez. "Many more studies have to be done to see which combinations of mutations cause this type of transmission before we can design the appropriate vaccines."

Perez will be talking this week with the NIH and the CDC to discuss his team's role in researching the current swine flu virus strain. Perez will likely do studies related to vaccine development, virus transmission between humans and animals, and the pathogenesis of the virus.

A virus vaccine is derived from the virus itself. The vaccine consists of virus components or killed viruses that mimic the presence of the virus without causing disease. These prime the body's immune system to recognize and fight against the virus. The immune system produces antibodies against the vaccine that remain in the system until they are needed. If that virus, or in some cases a closely similar one is later introduced into the system, those antibodies attach to viral particles and remove them before they have time to replicate, preventing or lessening symptoms of the virus.

The immune system also retains antibodies to a virus after being infected with it, so humans have general immunity to human strains of avian influenza strains. But humans do not generally have immunity to avian flu strains because they have not been infected by them before. The surface proteins are sufficiently different to escape the human immune response. Avian flu strains are therefore more dangerous for humans because the human immune system cannot recognize the virus or protect against it.

Provided by University of Maryland (news : web)