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**Ecology of influenza viruses :  
Avian influenza viruses as the origin of pandemic strains**

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Antigenic and genetic analysis of H3 influenza viruses isolated from migratory ducks, domestic ducks and pigs indicated that the hemagglutinin (HA) gene of A/Hong Kong/68 (H3N2) influenza virus was introduced into the precedent Asian (H2N2) strain from an influenza virus circulating in migratory ducks through domestic ducks and pigs in southern China. To assess the role of pigs in the generation of reassortants, the growth potential of 42 strains of influenza virus was examined in pigs. Of these, 38 were avian strains, including 27 with nonhuman-type HAs, H4-H13. At least one strain of each HA subtype replicated in the upper respiratory tract of pigs to a level equivalent to that of swine and human viruses. Co-infection of pigs with a swine virus and with an avian virus unable to replicate in this animal generated reassortant viruses, whose polymerase and HA genes were entirely of avian origin, that could be passaged in pigs. The results indicate that avian viruses of any subtype can contribute genes in the generation of reassortants.

Ecological studies on influenza viruses indicate that a vast influenza virus gene pool for future mammalian influenza exists in avian sources. Epidemiological surveillance of avian influenza, therefore, should provide information on the next epidemics for other animal species, including human pandemics. Influenza viruses of different subtypes were isolated from fecal samples of ducks and water samples of the lakes where they nest in central Alaska during their breeding season in summer. Even in autumn when the ducks had left for migration to the south, viruses were still isolated from the lake water. The results support the notion that influenza viruses are maintained in waterfowl population by water-borne transmission and revealed the mechanism of year-by-year perpetuation of the viruses in the frozen lake water while ducks are absent. Phylogenetic analyses of the genes of the isolates suggest that ducks carrying these viruses migrate through the continent of North America to the south and not to Asia. Surveillance study is now ongoing in Siberia and phylogenetic analysis of the isolates confirmed that ducks nesting in Siberia migrate to Asia.