

Epidemiological Investigation and Surveillance of HPAI



Prof. Xiaocheng Li

Dr. Jiming Chen

**China Animal Health and Epidemiology
Centre**

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Welcome!

- Distinguished Guests
- Silk Road
- Communication for thousands of years





A small questionnaire

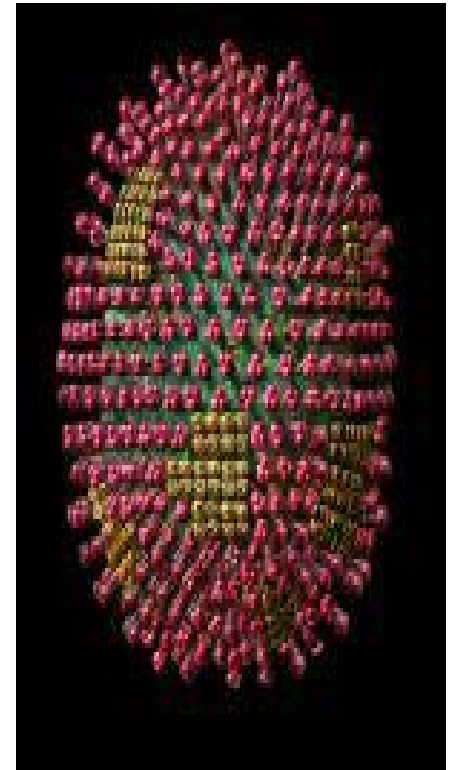
LP AI & HP AI

- LP AI: subclinical signs, egg decline
- HP AI: of high morbidity & fatality, chicken
- First: 1878 in Italy

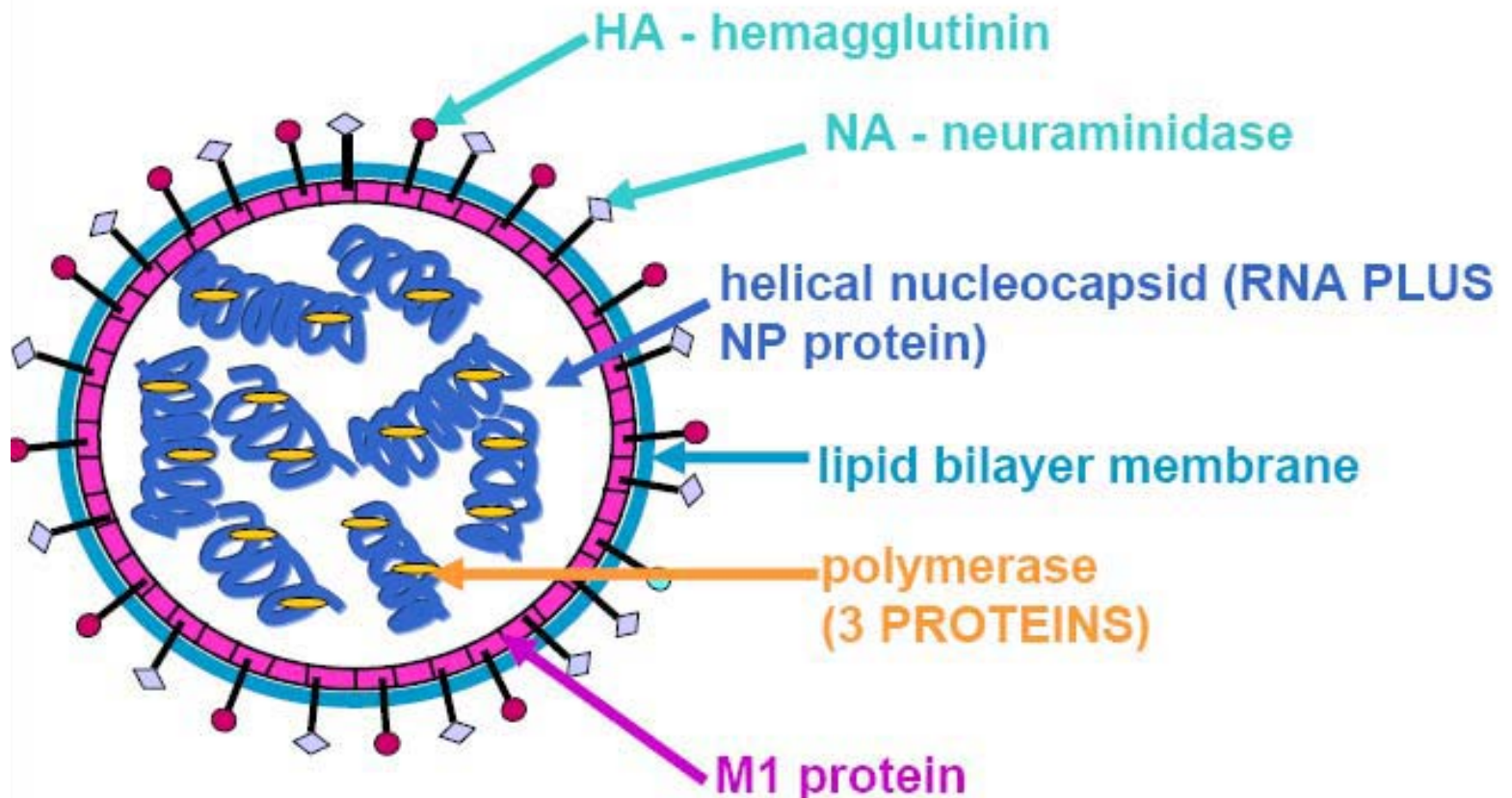


Avian influenza viruses (AIV)

- 16 HA subtypes
- Only H5 and H7 subtypes could be highly pathogenic
- Some H5 or H7 viruses not highly pathogenic



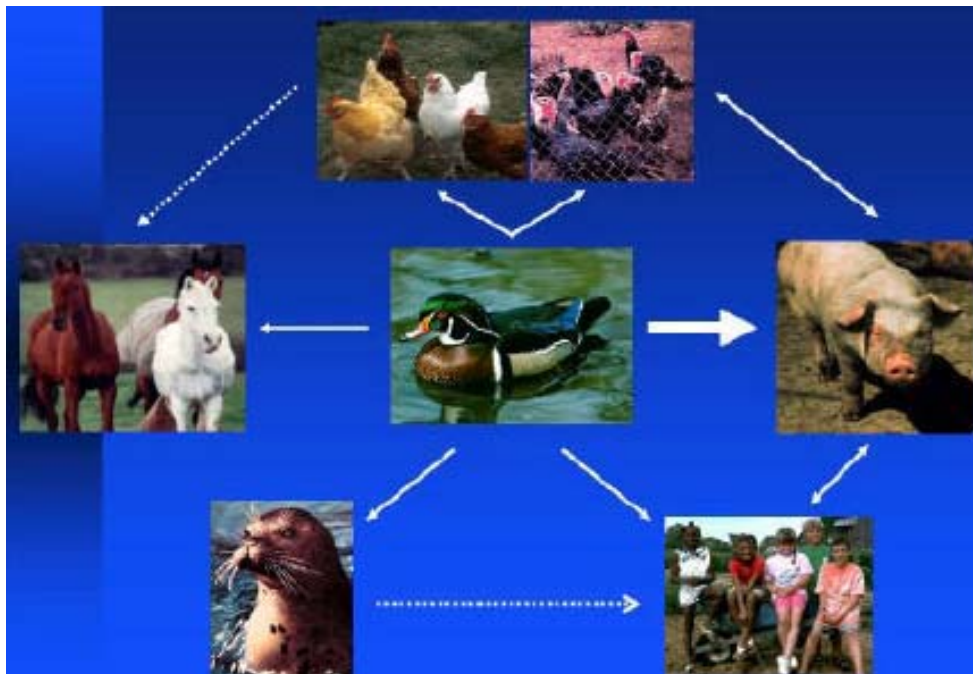
8 gene segments, 10 proteins



Pathogenesis: cleavage site sequence of HA protein

Natural reservoir

- Wild birds, esp. wild ducks, no clinical signs



- Chickens
- Horses
- Seals
- Pigs
- Humans



HPAI transmission

- **Reproduce in respiratory and digestion tracks**
- **Many viruses exist in faces**
- **Mechanical transmissions by shoes/cars/water/wind**
- **Far away: Migratory birds or transportation**



HPAI: huge economic losses

- 1983-1984 USA H5N2 17 million culled
- 1999-2001 Italy H7N1 13 million culled
- 2003-2007 much more fowls culled



HPAI: public health crisis

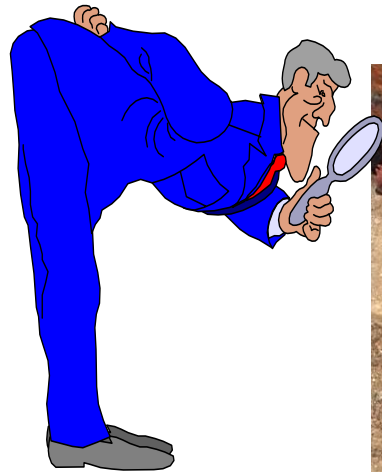
- Directly infect humans with high fatality
- Hundreds of human fatalities
- If transmit easily among humans: human pandemic



Crisis = Opportunity

- Capacity building for the control and prevention of animal diseases
- Veterinary significance recognized

1. Outbreak Investigation





Purposes

- Situation evaluation: where, what, how to control; whether has been well controlled
- Tracing in: from where?
- Tracing out: to where?
- Control inspection



How to do?

- **Organization**: who should give orders, who should do, who should support
- **Well-designed objectives**: what kind of information will be collected
- **Well-designed protocol or standard**
- **Well-trained technicians**



China: County activity

- For any suspicious outbreak of HPAI reported, the local county government should send qualified veterinarians to the spot to verify the report within 24 hrs
- If HPAI was suspected, the outbreak should be reported to the provincial veterinary administration station within 2 hrs, and then the provincial veterinary administration station should report the outbreak to the provincial government and MoA within 1 hr



China: Provincial activity

- Then, the provincial government should send qualified veterinarians to the spot to further verify the report within 24 hrs
- Samples should be collected and transported for laboratory diagnosis ASAP
- Inspect the control of the outbreak and take measures to prevent the outbreak spread to other counties



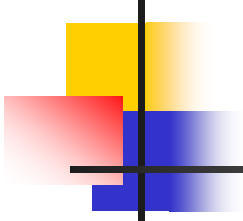
China: Central activity

- Give orders
- Supply with financial and technical support
- Inspect the control of the outbreak and take measures to prevent the outbreak spread to other provinces
- Report the outbreak to OIE and other international entities



Investigate what?

- (1) How many flocks/farms were infected (spatial distribution)?**
- (2) When they were infected (time distribution)?**
- (3) Why they were infected?**
- (4) What about the morbidity and fatality?**
- (5) From where?**
- (6) To where?**
- (7) What have done for control and prevention of the outbreak?**
- (8) Which flocks should be slaughtered?**
- (9) Which flocks, e.g. if well vaccinated, need not be slaughtered?**
- (10) Whether the outbreak will be or has been well controlled?**







Burning the culled chickens before burying



2. Epidemiological Surveillance





Significance

- Basis for policy-making
- Evaluation of policy



How to do?

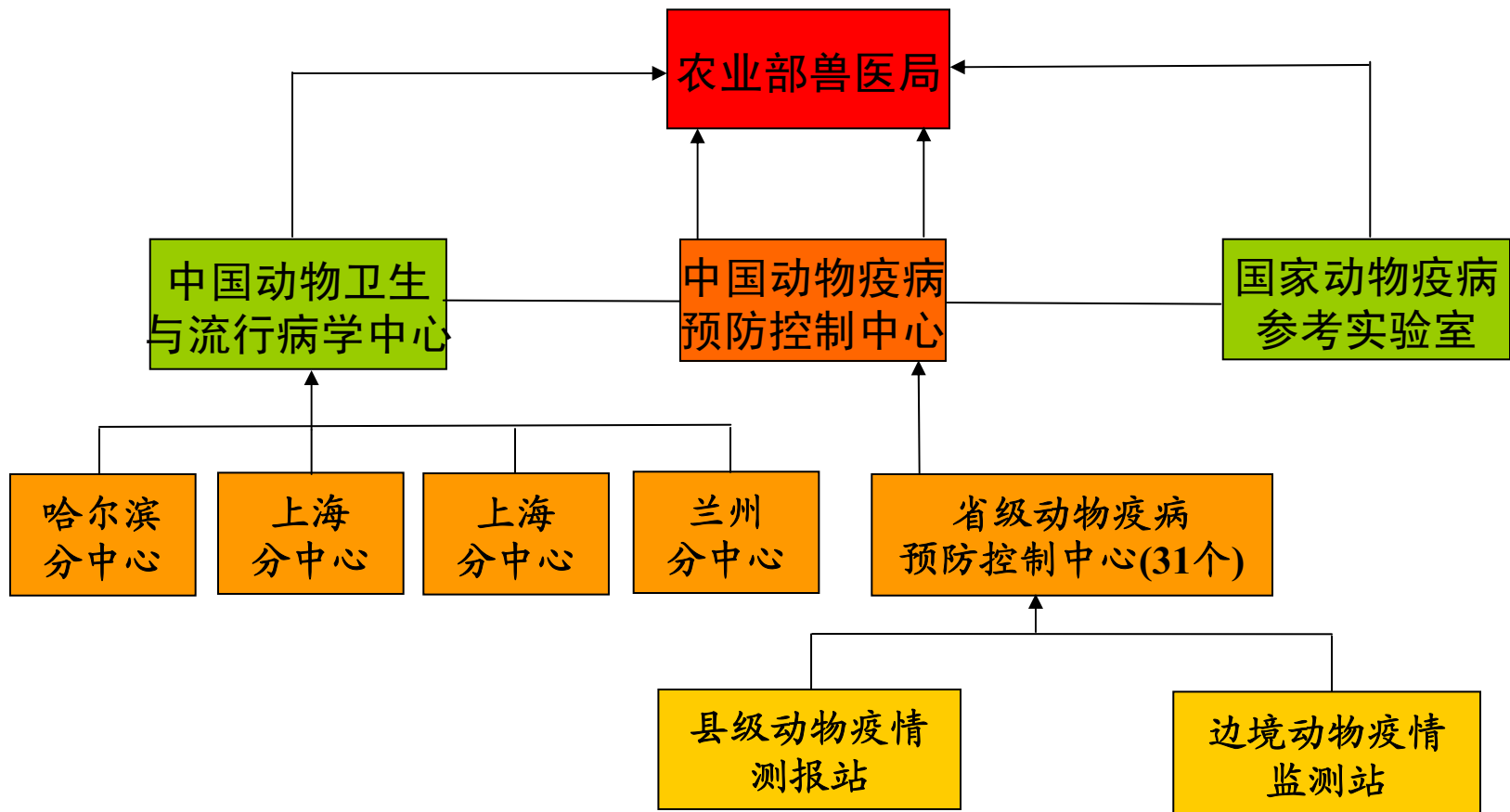
- **Organization**: who should give the order, who should do, who should support
- **A panel of laws, regulations, standards and programs**
- **Well-designed objectives**: what kind of information could and should be collected
- **Well-trained technicians**



Surveillance methods

- Serological surveillance
- Pathogenic surveillance
- Sentinel animals

China: Organizations



National surveillance system

- 146 border surveillance stations
- 300 surveillance stations at the areas with high animal density
- 2,800 Surveillance Labs and stations at county level with serological test capability
- 31 Surveillance Centers (Labs) at Provincial level with RT-PCR detection capability
- 3 National surveillance Centers such CCADCP, CAHEC, CNAIRL with BSL-3 Labs

China has established the animal diseases surveillance system at Central, provincial, municipal and county levels.

全国边境动物疫病监测站、疫情测报站分布图





China: County responsibility

- Regular clinical inspection in the county
- Record the vaccination and road quarantine activities
- Report suspicious cases
- Support the provincial and central surveillance activities, esp. sampling



China: Provincial responsibility

- Analyze and investigate reported outbreaks ASAP
- Regular laboratory surveillance in the province, usually twice a year
- Support the central surveillance activities, esp. sampling
- Inspect and coordinate the county activities



China: Central activity

- Make the laws, regulations, standards and programs
- Inspect and coordinate the provincial activities
- Carry out national epidemiological surveillance

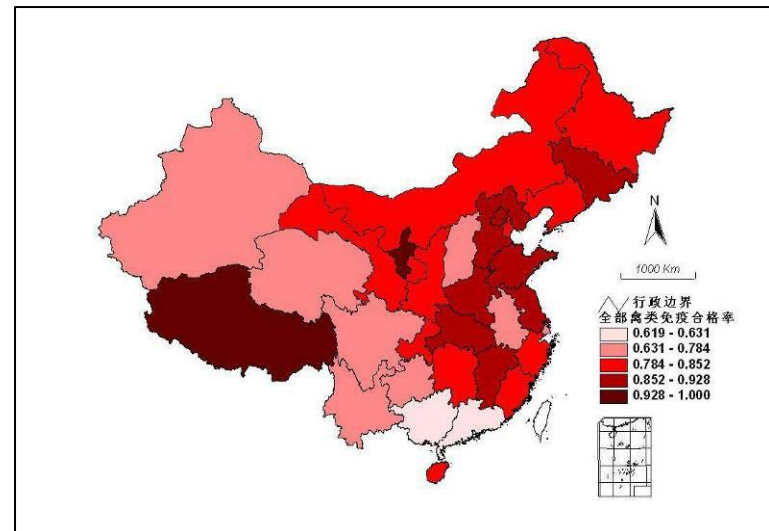
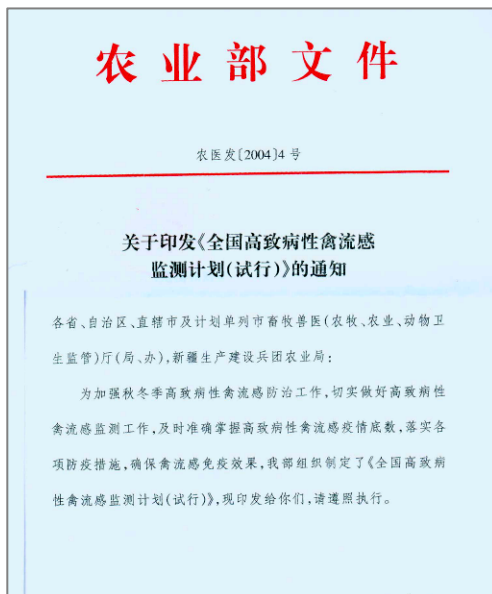


Laws, regulations, standards and programs

- 《中华人民共和国动物防疫法》
- 《动物病原微生物分类名录》
- 《国家动物疫情测报体系管理规范（试行）》
- 《动物疫情报告管理办法》
- 《国家突发重大动物疫情应急预案》
- 《全国高致病性禽流感应急预案》
- 《2005年秋冬季防控高致病性禽流感应急实施方案》
- 《高致病性禽流感疫情处置技术规范》

National programs

- ***The National Surveillance Program for HPAI*** issued annually by MOA.





Surveillance in 2006 (1)

From Jan-Oct, on domestic fowls:

- 4.8 million vaccinated sera samples: 86.86% with protective antibody titer
- 452,400 unvaccinated sera samples: none positive
- 318,900 pathogenic samples: 24 positive

<http://www.agri.gov.cn/cwggk/xgzl/P020061227356059896189.pdf>



Surveillance in 2006 (2)

From Jan-Oct, on wild birds:

- 680 vaccinated sera samples: 2 positive
- 18,300 pathogenic samples: 16 positive from **Liaoning, Tibet and Qinghai**

<http://www.agri.gov.cn/cwggk/xgzl/P020061227356059896189.pdf>



Surveillance in 2006 (3)

From Jan-Oct, on other kind of birds (ostriches and quails, etc):

- 11,542 vaccinated sera samples: 60.55% with protective antibody titer
- 203 unvaccinated sera samples: none positive
- 10,740 pathogenic samples: 1 positive from Guizhou

<http://www.agri.gov.cn/cwgk/xgzl/P020061227356059896189.pdf>



Surveillance in 2006 (4)

From Jan-Oct, on pigs:

- 8,400 vaccinated sera samples: 10 positive
- 21,000 pathogenic samples: 0 positive

<http://www.agri.gov.cn/cwgk/xgzl/P020061227356059896189.pdf>

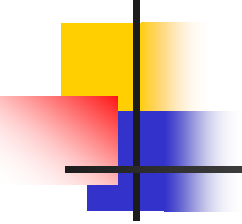


Surveillance in 2007

- **Covers more regions**
- **My laboratory: 13 provinces and 26 sites**







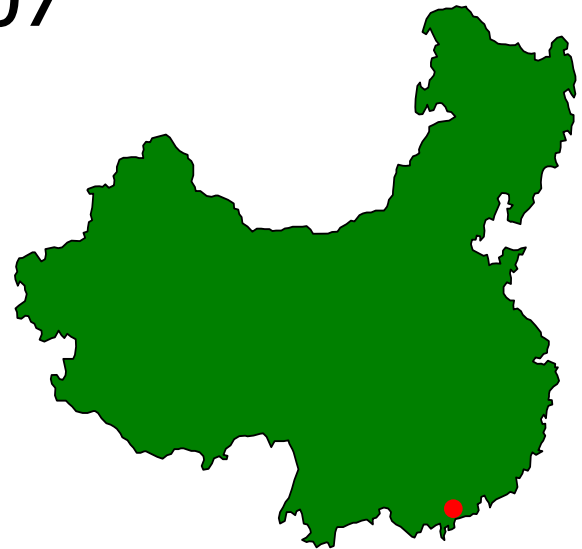
What should be answered for a national HPAI epidemiological surveillance?

- Whether there are HPAI infections?
- Whether there were HPAI infections?
- What about the risk of HPAI infections?
- What are the features of HPAI infections in the nation?
- Which aspects are important and easy-to-do for the control of HPAI?
- Whether the outbreak has been well controlled?
- Whether the control measures are effective?



Whether there are HPAI infections in China?

- New outbreak in ducks in Guangzhou in Sep. 2007





Whether there were HPAI infections in China?

YEAR	Outbreaks	Died (1000)	Slaughtered (1000,000)
2004	50	129	8
2005	32	155	23
2006	10	47	3
2007 >August	2	1.2	0.06



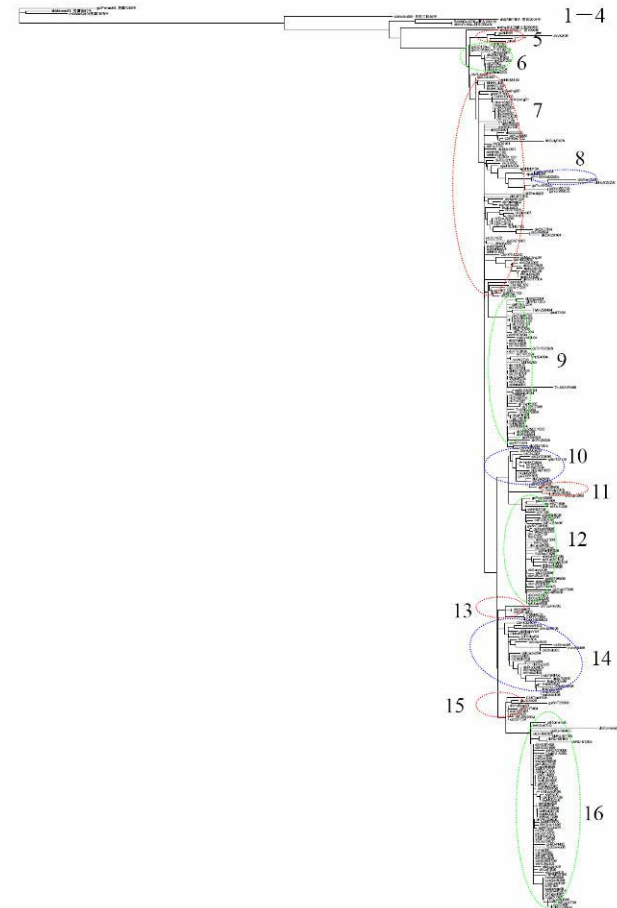
What about the risk of HPAI infections in China?

- Though well controlled with mass vaccination, VERY HIGH
- What if we stop the mass vaccination?

What are the features of HPAI infections in China?

Multiple sublineages co-existed

- Shanxi-like virus: North
- Qinghai-like virus: West
- Fujian-like virus: South





Remains only H5 subtype HPAI in China

- H5 and H7 subtypes in mid-Asia



No differences between wild and domestic birds

- Wild birds to domestic birds
- Domestic birds to wild birds



The small poultry farms were easy to be attacked

Farming Scale	Outbreaks	Percents
Backyard flocks	6	6.6%
100-10,000	80	87.9%
10,000-50,000	5	5.5%
More than 50,000	0	0%



Most human cases were linked to backyard domestic birds

- Possibly more circulation could exist in backyard domestic birds
- Roam freely, difficult to be vaccinated, easy to be infected, difficult to eliminate and control the spread

Most of the virus isolated in surveillance were from ducks

- Ducks: bridge between wild and domestic birds
- Ducks: reservoirs, AIV amplification pool
- China owns the biggest duck population, 70% of the total in the world



Which aspects are important and easy-to-do for the control of HPAI in China?

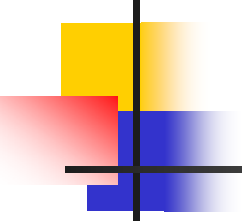
- Mass vaccination
- Duck raising limitation
- Live market banning
- Live animal transportation





Question 1: Does H5N1 HPAI originated in China?

- H5N1 HPAI existed at least for decades and continuously in wild birds
- The current H5N1 HPAI at least can be traced back to the H5N1 outbreak in 1959 from genetics and evolutionary biology



Question 2: When will H5N1 HPAI disappear from the world?

- No one knows
- Not in the near future
- Work opportunity
- International exchange opportunity
- Collaboration



谢谢大家!

Thanks for your attention!