Influenza and the Poultry Link
# Type A Influenza Surface Antigens

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- 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 are the subtypes of the antigens.
## Type A Influenza Surface Antigens

### Subtype Surface Antigens

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Type A Influenza virus – role of birds (bird flu?)

Waterfowl

present for 105 million years
find all subtypes of flu
asymptomatic
intestinal infection
excrete large amounts of virus into water
Type A Influenza virus – role of birds (bird flu?)

Domestic birds (chickens, etc):

50 million years
respiratory infection/illness
can shed lots of virus from respiratory and
GI tract (route of spread)
can become very ill or die acutely with
infection
Avian Influenza
*Spectrum of Disease:*

**Low Pathogenic**
- No or mild disease

**Highly Pathogenic**
- Acute, systemic disease
  - edema
  - hemorrhage
  - high mortality

Senne, USDA, NVSL
Pathogenesis of AI

Replication at point of entry

Low Path strains

Respiratory / Intestinal replication

Few basic amino acids
(B-X-X-R)

High Path strains

Viremia

Systemic infection

Multiple basic amino acids
(B-X-B-R)

Senne, USDA, NVSL
Poultry meat:

infected birds with low pathogenic avian influenza

virus from GI tract/respiratory tract

no virus found in breast meat or thigh meat

Swayne, Beck
Avian Dis. 49:81-85, 2005
Avian Influenza

**Factors Influencing Pathogenicity:**

- Usually H$_5$ or H$_7$ subtypes
- HA plays dominant role
- Multiple basic amino acids at HA cleavage site
- Highly pathogenic AI strains evolve from nonpathogenic lineage
Highly pathogenic AI strains evolve from nonpathogenic lineage

1983-84 outbreak of highly pathogenic H$_5$N$_2$ avian influenza in flocks in Pennsylvania

State of Emergency Declared:
$63$ million spent
$443$ affected flocks
$17$ million birds depopulated
Connecticut: Nov 2001

H₇N₂ antibodies discovered
1 ill flock of chickens
flock depopulated

trade embargoes follow
Pennsylvania: Dec 2001 - Jan 2002

H$_7$N$_2$ low pathogenic influenza isolated
9 flocks in Union and Snyder Co.
flocks depopulated

embargoes follow
U.S. Agricultural Research Service export projections for 2002:

- 3.2 million tons of product
- $2.3 billion
Embargoes

Japan banned import of all poultry & poultry products from US

China banned all of PA origin
Japan

5th largest importer of US poultry and poultry products

~$130 million annually
~ $10 million caught en route

all of U.S. for 5 weeks
then just on PA origin poultry/products
Russia
2001

purchased ~ 1 million tons of U.S. poultry worth approximately $700 million

March 9, 2002 - banned U.S. poultry
World Events
Hong Kong 1997-1998

H$_5$N$_1$ isolated
avian influenza jumps species barrier
18 people ill
6 die

Jan-Feb 1998 depopulated all live bird markets
Hong Kong - Feb 2002

recurrence of H₅ influenza
traced to farms in China
flocks depopulated
markets in Hong Kong depopulated, cleaned and disinfectede

No human involvement
Winter 2003 - 2004

reports of sick, dying birds (poultry) from South Korea

additional reports from Viet Nam and other countries in South East Asia

later China reports bird losses and possibly human cases

DX: $H_5N_1$ highly pathogenic avian flu virus
Ultimately 8 Asian countries with HPAI (H$_5$N$_1$) in chicken flocks - 100 million birds culled or died

South Korea
Viet Nam
Thailand
China
Japan
Cambodia
Indonesia
Laos
This may fit for migratory waterfowl arriving to winter in southern China, but what is the evidence for migratory birds transmitting H5N1 across the region?

There are no wild migratory birds that spend the winter in southern China and then migrate further south to Southern Vietnam, Cambodia, Indonesia, central Thailand, nor north to Korea…

Plus the number of wild migratory bird species that overlap ecologically with domestic waterfowl or poultry at any time is extremely limited.
Recent World Events Outside Of Southeast Asia
Feb 2004
reported low pathogenic H$_7$N$_3$
18,000 birds euthanized
British Columbia

Mar 10, 2004
2$^{nd}$ flock found positive for H$_7$N$_3$
depopulated 36,000 birds on 7 house farm
2 kilometers from 1$^{st}$ flock
HIGH PATH
Apr 14, 2004

additional confirmed positive flocks:

28 commercial flocks
- 10 w/in ‘high risk’ region
- 15 w/in ‘surveillance and control’ region

10 non-commercial flocks

U. S. and 15 other countries ban poultry & poultry products
Netherlands

Largest exporter of poultry to the E.U.

2003 – High Path H$_7$ virus
  culled approx. 25% of poultry in the country
  30.7 million birds in 1300 flocks
  1 human death/workers with conjunctivitis

Mar 2004 – reported antibodies to avian flu
  culled duck flock w/antibodies
  culled 36,000 chickens for same reason
U. S. Events, 2004
Delaware

Feb 5 - ill birds reported, samples collected quick test - AI positive (clinical onset 2/3)

Feb 7 - depopulated 12,000 birds on index farm

Feb 7 - lab confirms low pathogenic H₇N₂ virus
Delaware

Feb 9 – 73,800 broilers ill
outside the 6 mile surveillance zone
commercial flock
70% morbidity, slight increase in mortality
3 poultry houses on the farm

low pathogenic avian influenza H₇N₂
Texas

Feb 17 - report of positive H₅ (highly pathogenic) 
Gonzalez County, TX

Feb 21 - depopulated 6,600 birds on index farm
Maryland

Mar 5 - report of positive low pathogenic H\textsubscript{7}N\textsubscript{2}
Pocomoke City, MD

Mar 7 - depopulated 118,000 birds on farm

Mar 9 - depopulated an additional 200,000 birds
International Response

- 42 countries banned U.S. poultry and poultry products

- 23 were U.S. wide bans

- others are state-by-state or state and contiguous state bans
Question: So how does Agriculture handle the finding of avian influenza?
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Answer: It depends.
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Answer: It depends.

1. What type of flu is it? (pathogenic or potentially path; H5 or H7 or other)
2. What is the status or use of the flock/bird? (backyard, commercial)
3. What is the risk of the flock to others? (spread)
4. What are the potential trade implications? (embargoes)
5. What options are available for control/eradication?
Available options?

1. Quarantine

2. Depopulation, cleaning and disinfecting of premises

3. Vaccinate

4. Surveillance around infected flock(s)
Question: So how does Agriculture handle the finding of avian influenza?

Answer: Carefully.