Viral diseases of poultry
Avian infectious bronchitis disease

BY, ASSISTANT PROF
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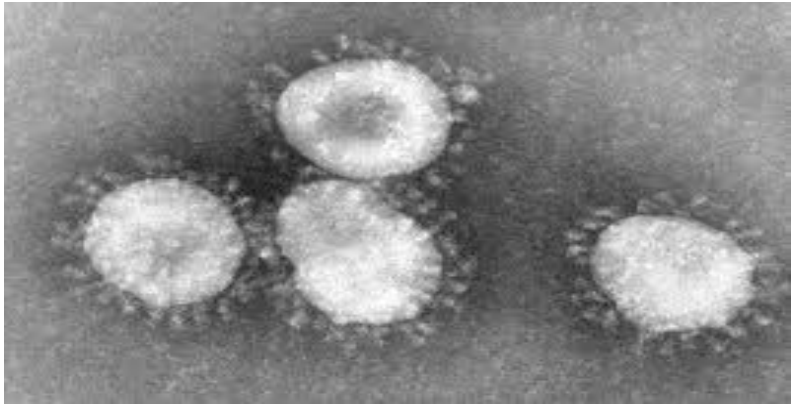
It is an acute, highly contagious respiratory disease of chickens mainly.
Produce severe economic losses due to high mortality.
The disease occur worldwide.
Initially, IB was recognized as a disease of **young chicks**. However, it was later observed commonly in semi-mature and laying flocks, **hence**, all ages are susceptible to this infection.

This disease was targeted to respiratory tract and urogenital tracts.
IBV mainly causes respiratory disease in the infected birds, decrease in egg production and affect both internal and external egg quality.

- False layers
- Kidney damage can also occur.

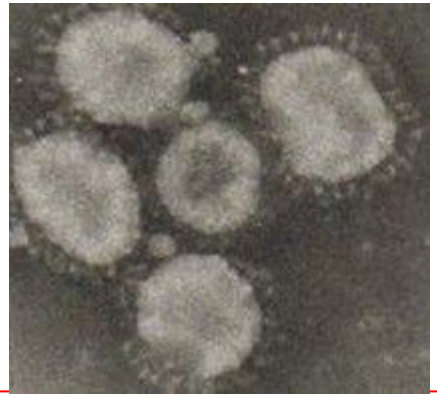
IBV poses a major threat to the poultry industry and was first reported in 1931 in North Dakota, USA, as a novel respiratory disease. Infectious bronchitis infection affects the growth rate of broilers as well as egg production in layers and breeders. Broilers may perform badly due to poor feed conversion and reduced weight gain.

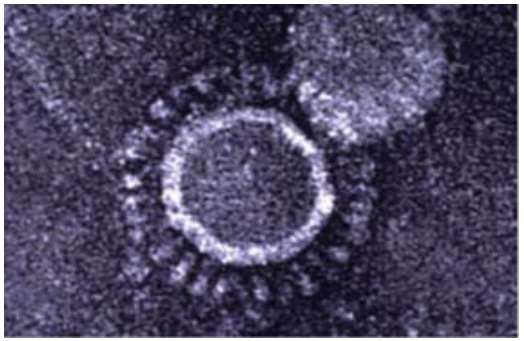
IBV infection has remained a problem in **the Iraqi poultry industry** causing mortality and adverse effects on quantity and quality of egg production as well as renal failure lead to high range of mortality in broiler chickens due to infections with strains serologically different from those used for vaccine serotypes lead to causing major economic losses to the global poultry industry.



Etiology:
IBV, enveloped virus with spikes, pleomorphic, ss positive sense RNA genome. The virus is a member of the genus Coronavirus, family *Coronaviridae,* order **Nidovirales**.

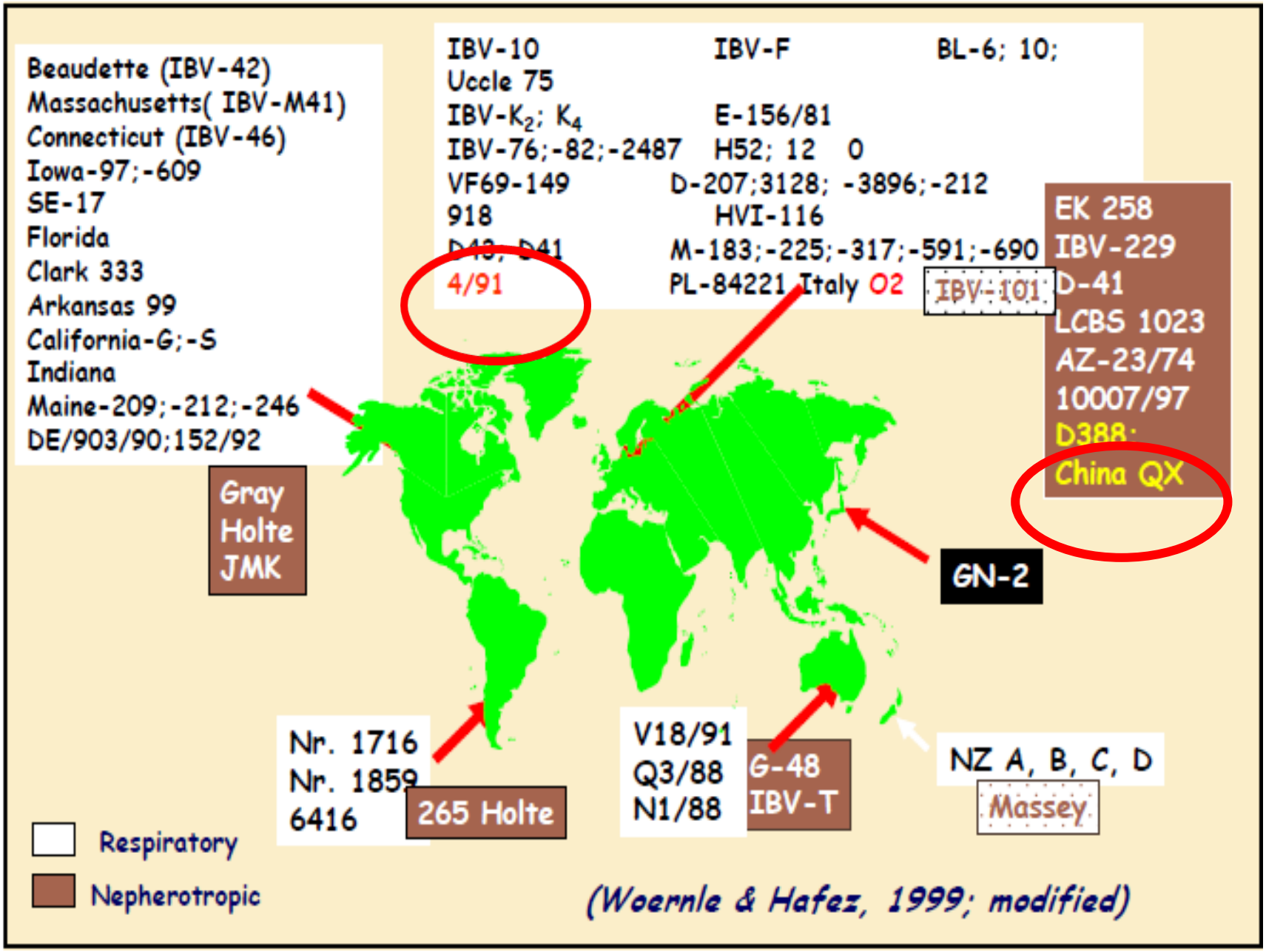
Many serotypes and strains with great antigenic variation have been identified from all over the world and **more may found in the future**, that lead to high morbidity in all ages of chickens and high mortality in chicks less than **3 weeks old.**
Initially, it was believed that all the isolates belong to a single prototype termed Massachusetts (Mass) serotype mostly isolated from commercial poultry.





Subsequently, other serotypes were isolated and it is clear now that a considerable number of different serotypes with antigenic and pathogenic differences exist in different parts of the world, also different strains affect different organ systems such as: **Respiratory**, **Renal**, **Reproductive**. Some important field strains are, Massachusetts (M41,H 120), Arkansas 99, D 1466, D3128, Delaware, Florida, California, Holte, **(4/91also named 793/B and CR88**), D388, B1648/D8880, Gray, T-strain, etc, ***And*** in more recent times (**QX-like IBV**), which was associated predominantly with various forms of renal pathology (nephropathogenic strains).

In recent study from 10 countries by Ceva laboratories, they found that from 234 flocks infected with IBV(34 flocks with Mass, 74 with 4/91, 90 with QX) and the rest distributed with other strains.

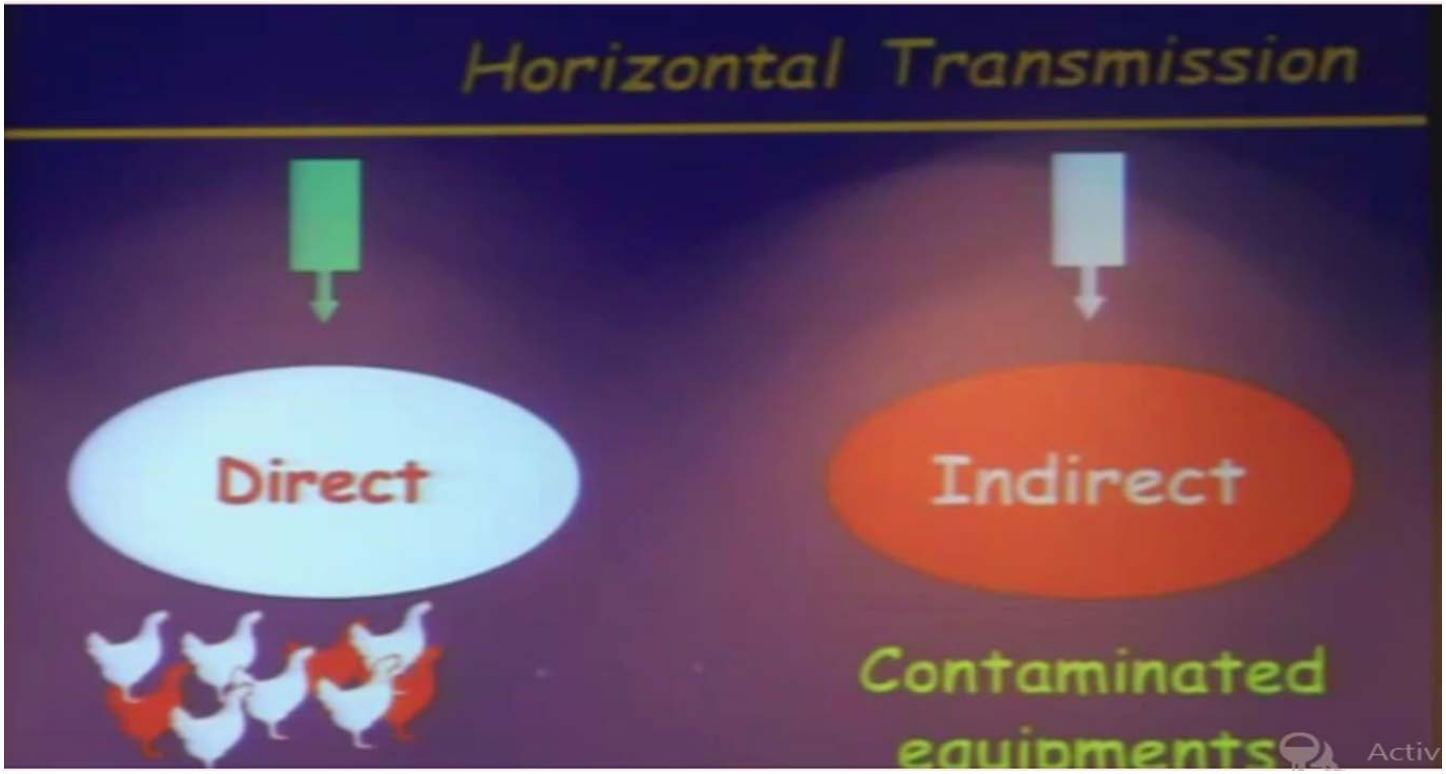

Beaudette (IBV-42)
Massachusetts(IBV-M41)
Connecticut (IBV-46)
Iowa-97;-609
SE-17
Florida
Clark 333
Arkansas 99
California-G;-S
Indiana
Maine-209;-212;-246
DE/903/90;152/92
Gray
Holte
JMK
IBV-10
Uccle 75
IBV-K2; K4
IBV-76;-82;-2487
VF69-149
918
4/91
IBV-F
E-156/81
H52; 12 0
D-207;3128; -3896;-212
HVI-116
M-183;-225;-317;-591;-690
PL-84221 Italy 02
BL-6; 10;
IBV-101
EK 258
IBV-229
D-41
LCBS 1023
AZ-23/74
10007/97
China QX
GN-2
Nr. 1716
Nr. 1859
6416
265 Holte
V18/91
Q3/88
N1/88
G-48
IBV-T
NZ A, B, C, D
Massey
Respiratory
Nepherotropic
(Woernle & Hafez, 1999; modified)

Transmission

❖ Horizontally by :

1- Direct contact: Aerosol transmission (sneezing) which was most common.

2- Indirect: By Contaminated organic material, drinking water and equipment.



- **Vertically** (from the hen to their progeny through the eggs) has not been shown to be important.

However, surface contamination of eggs with the IBV is a possible by which the virus can spread in hatcheries.

IB is highly contagious so the incubation period is relatively short, 18-36 hours. Disease spreading through entire flock within one or two days. (positive-sense genome)

Economic Important

In broilers, producer losses from IB occur due to poor growth and feed conversion, secondary bacterial infections that require antibiotic treatment and increased condemnations at slaughter.

Layers and Breeders

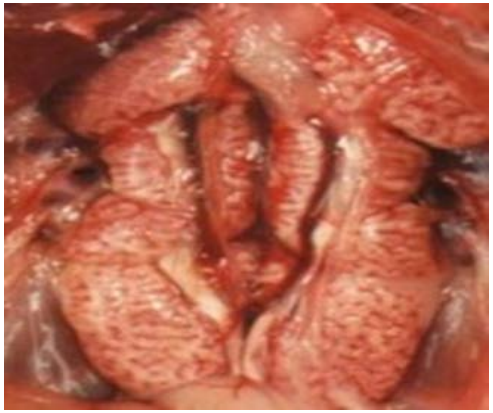
When birds are infected in the first few days of life with a very virulent IB virus:

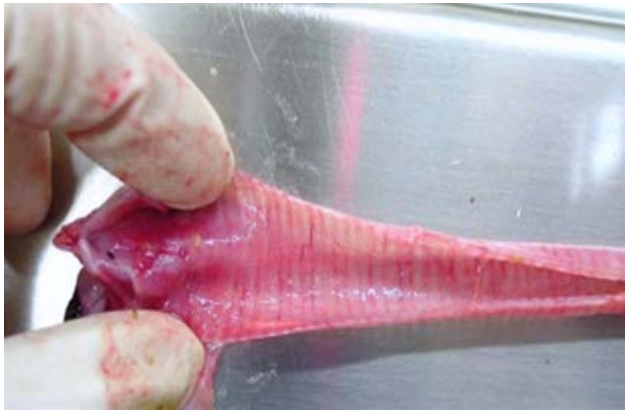
1- Permanent damage in the oviduct may occur.

- These birds may mature like normal hens but produce no eggs.
- These so-called false layers have in the meantime consumed their full share of the investment in food and housing without any return.
- Drops in eggs production.
- Poor quality eggs.
- Production often does not return to pre-infection levels.

Pathogenesis

- IBV initially infects an and replicates in the **upper respiratory tract** causing the loss of protective cells lining the **sinuses and trachea**.
- Within three days of the infection, virus titres are maximal in the nose and trachea and remain for other two to five days
- After a brief viraemia, the virus can be detected in other non-respiratory organs such as **kidneys, reproductive tract**, and **caecal tonsils**. (in kidneys, causing minor and major nephritis),
- Renal damage associated with different IB strains is an increasingly important feature of IB infections, especially in broilers.





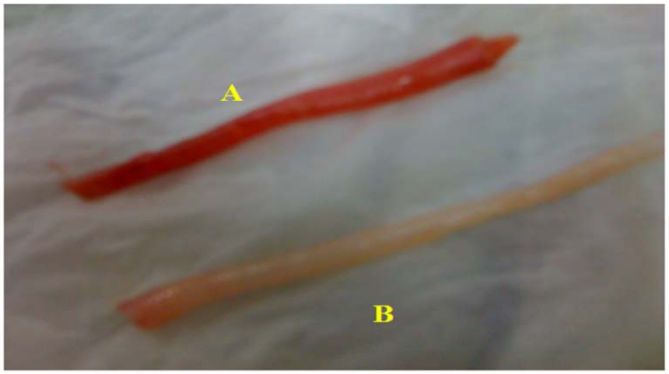


Figure 1, A- Diffuse congestion of tracheal broiler chicken infected with IBV at 3 weeks age
B- Normal trachea of broiler chicken at 3 weeks age

Clinical Signs

❖ - Young birds are depressed and huddle under the heat source. ruffled feathers, respiratory distress including:

- Gasping, Coughing, Tracheal rales, Nasal discharge.
- Mild serous nasal discharge and an occasional but infrequent gasping reflex accompanied by extension of the head and neck, sometimes accompanied by lacrimation, facial swelling, and death rate of 40% Some dyspnea with abdominal breathing was observed, more frequently in groups with mixed infections.
- **Study by the presenter in Diyala** showed that mortality in infected flocks reached between **30-40% during 5-7days**, the noticeable lesions of infected chickens showed lesions that identified primarily in the upper respiratory tract, characterized by severe congestion with serous, catarrhal, or caseous exudates in the trachea, nasal passages, and sinuses

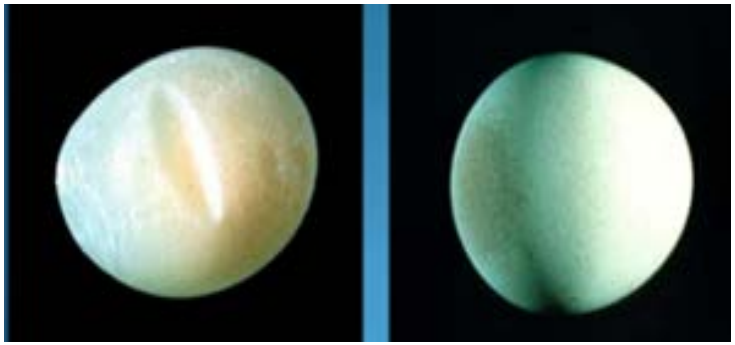
Clinical Signs

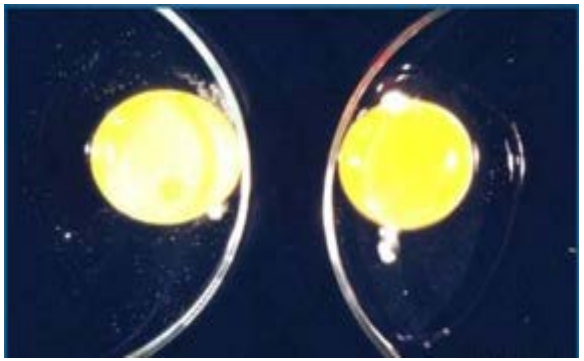
❖- Layer Birds

❖Have a marked drop in egg production and an increased number of poor quality eggs may be produced and internal ovulation may occur.

❖- The external and internal quality of the eggs may be affected, resulting in misshapen or soft-shelled eggs with watery content.

❖-Production often does not return to pre-infection level, in addition to the hatchability rate of the eggs may be affected.





IB - Clinical signs

False Layer

Respiratory
Kidney damage

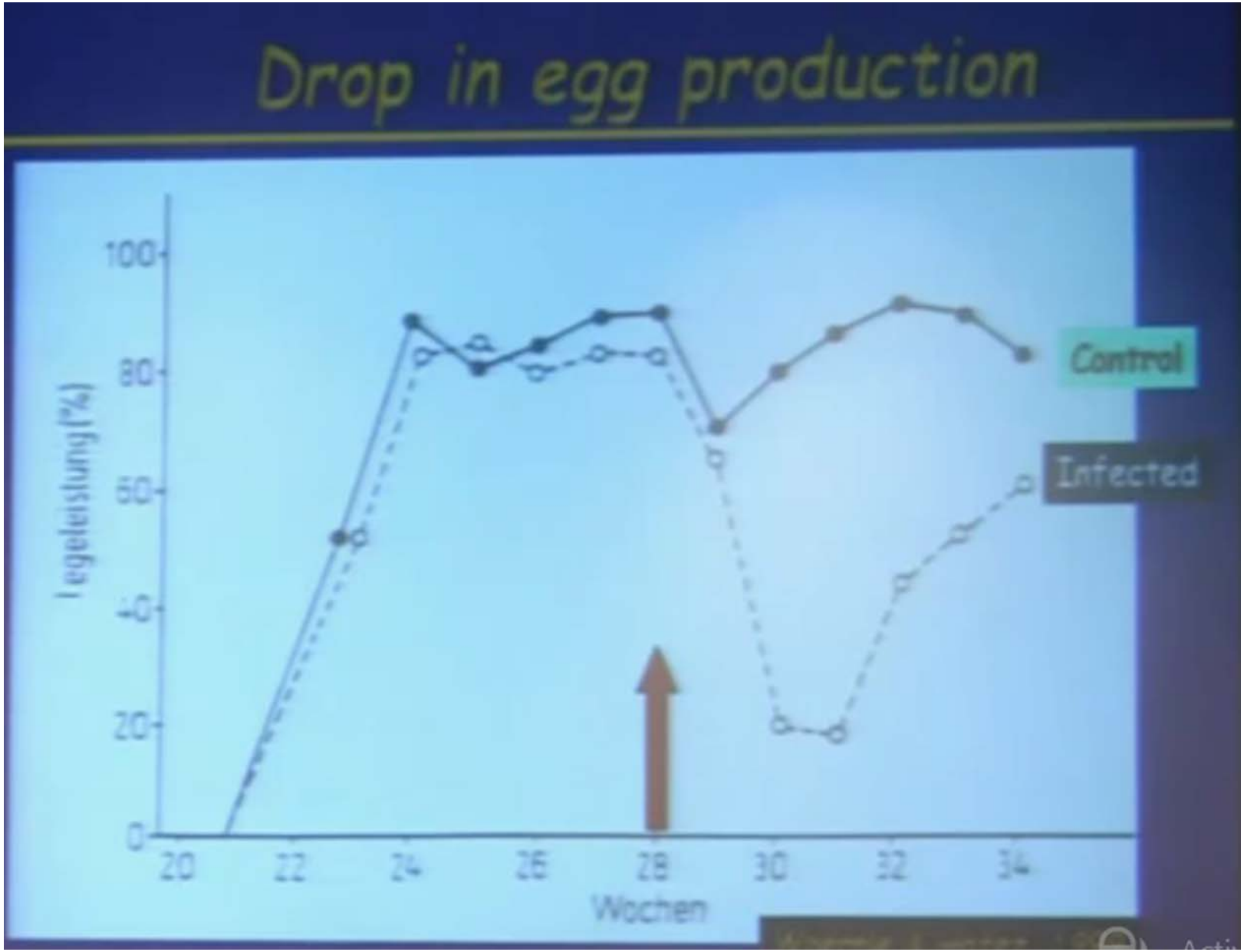
Production
Respiratory

Early infection

Rearing

Production
> 18 weeks

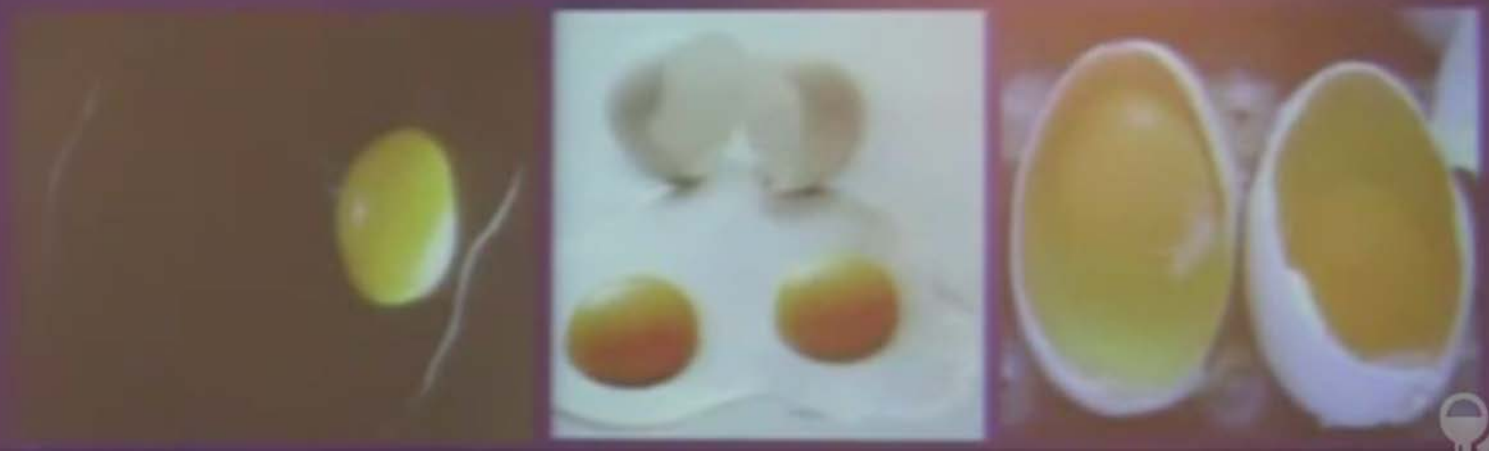
Drop in egg production



IB - Clinical signs - Layer & Breeder

Reduced internal egg quality (thinning of the thick albumin)

"watery whites"



IB - Clinical signs - Layer & Breeder

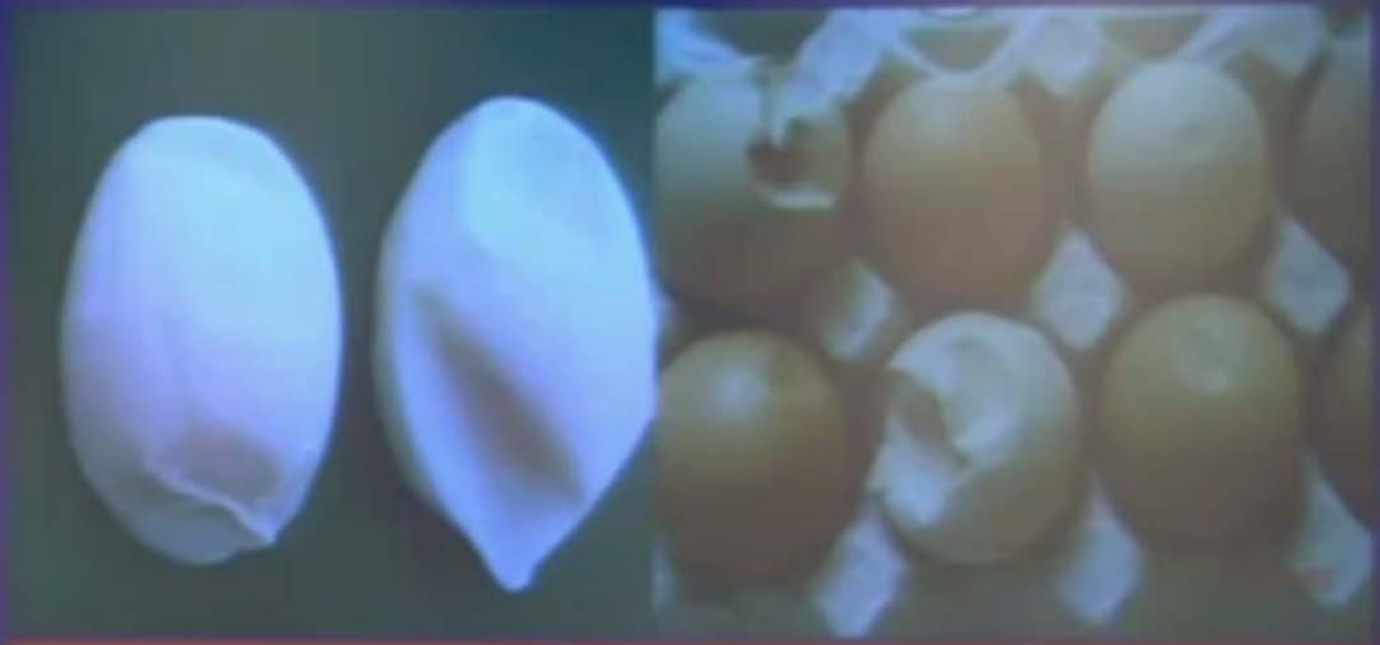
Drop in egg shell quality for
6 - 8 weeks /or months

Rough shell

Misshapen eggs

IB - Clinical signs - Layer & Breeder

Drop in egg shell quality for
6 - 8 weeks /or months



Thin shell

IB - Gross lesions - Layer & Breeder

Neonatal infection

↓

Damage of the oviduct

↓

Non-laying hens

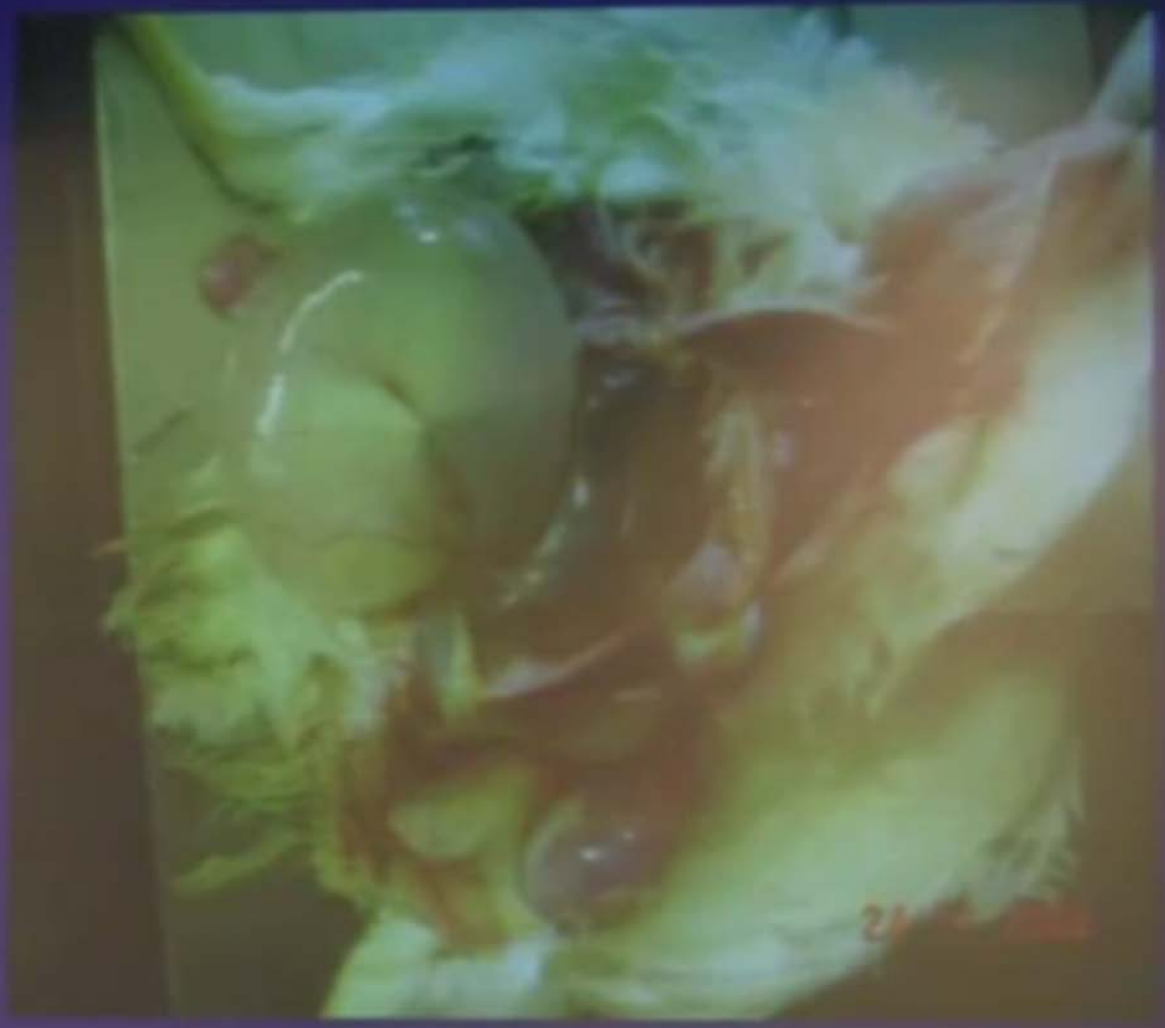
↓

"false layer"

IB - Clinical signs - Layer & Breeder

False Layer ?

IB - Clinical signs - Layer & Breeder



❖ **Infected kidney**

❖ **When the kidneys are affected,**

❖ Depression, ruffled feathers, increased of water intake,

❖ scouring and wet litter are commonly observed, high mortality (up to 80%).

❖ The most sever clinical signs are seen in chickens younger than 3 weeks of age.

❖ The **morbidity** rate is extremely high.

The mortality rate is depended on:

➢ **Age** of chickens when infected.

➢ **Presence** of secondary invading organisms such as **E.coli.**

Post Mortem Lesions appearance:

- **Post mortality, lesions are found in the respiratory tract and urogenital tract.**
- **Renal damage associated with different IB strains is an increasingly important feature of IB infections, especially in broiler.**

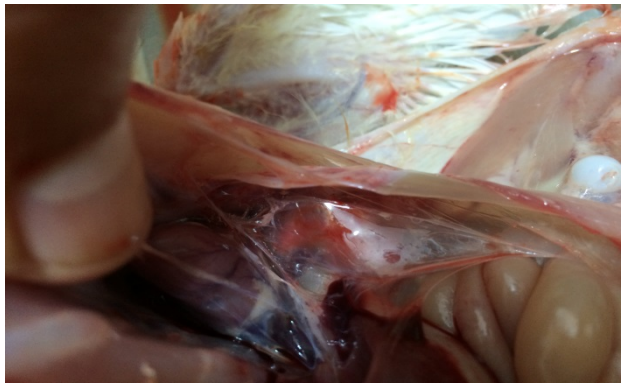
Respiratory

1-Serous, catarrhal, or caseous exudates in the trachea, nasal pass

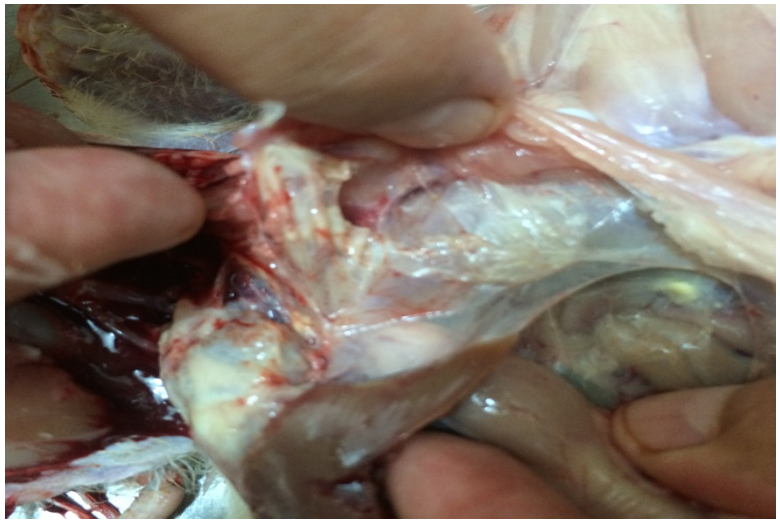
2-Cloudy air sacs which may contain yellow caseous exudates.

3- Caseous plug may be found in the trachea.

4- Pneumonia.

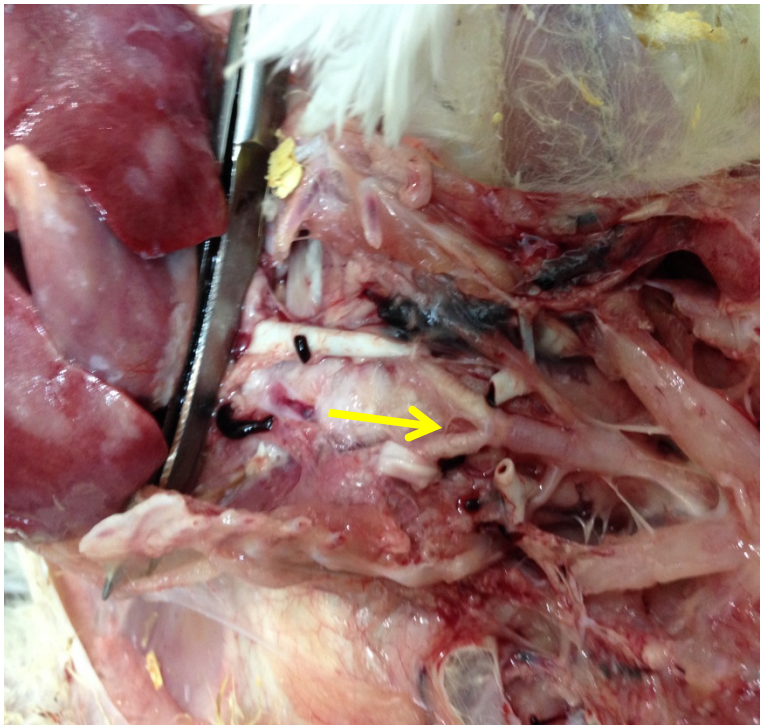


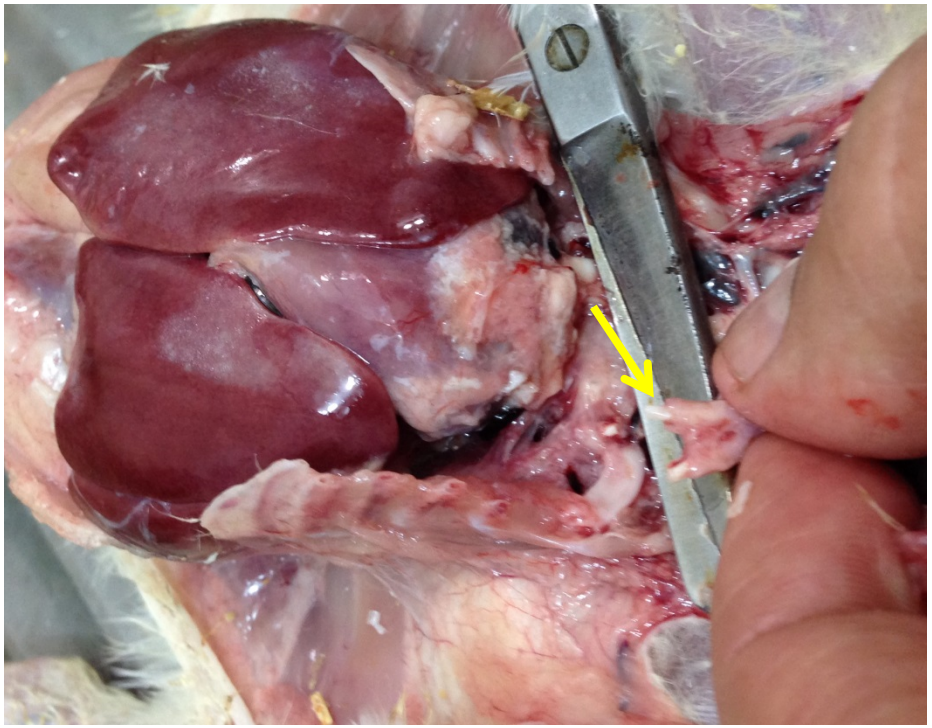
Normal



Infected

For my experience in **Diyala broiler flocks**(the most prominent lesion in respiratory disease infected flocks is severe exudation in trachea, which leads to tubular cast formation in the tracheal bifurcation and extending to the lower bronchi).

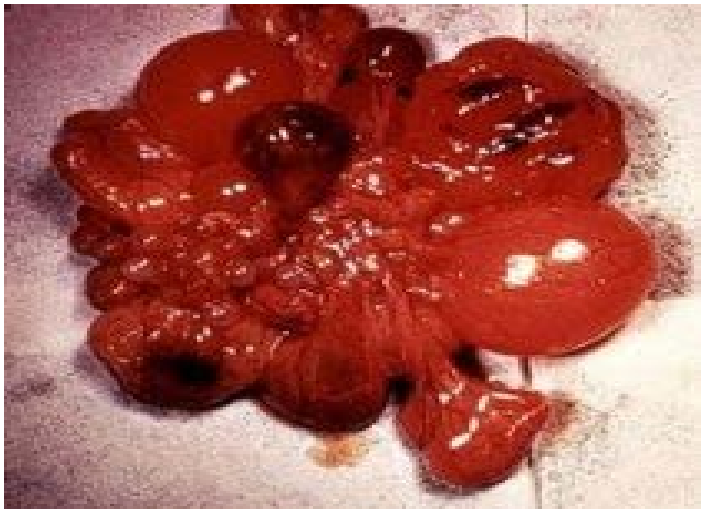




❑ Urogenital

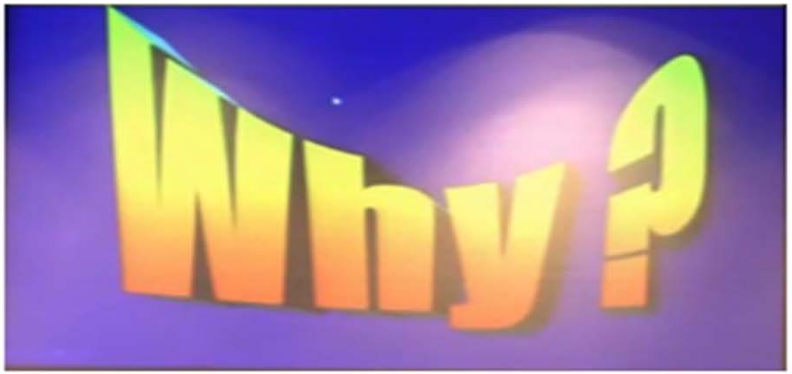
1- Swollen, pale kidneys, with distended tubules and ureters containing urate crystals in nephropathogenic cases.

2- Fluid yolk material may be found in the abdomen of the birds in production (egg peritonitis).Degeneration of the ovary and swollen of the oviducts.



Diagnosis

Diagnosis of infectious bronchitis on the basis of clinical sings alone is very difficult.




?
What is the Problem?

Diagnosis

Problems related to diagnosis

*_ Clinical signs
*_ Gross lesions

not specific

Diagnosis

Respiratory signs similar to IB are observed in many other respiratory diseases such as:

1- ND

2- AIV

3-ILT

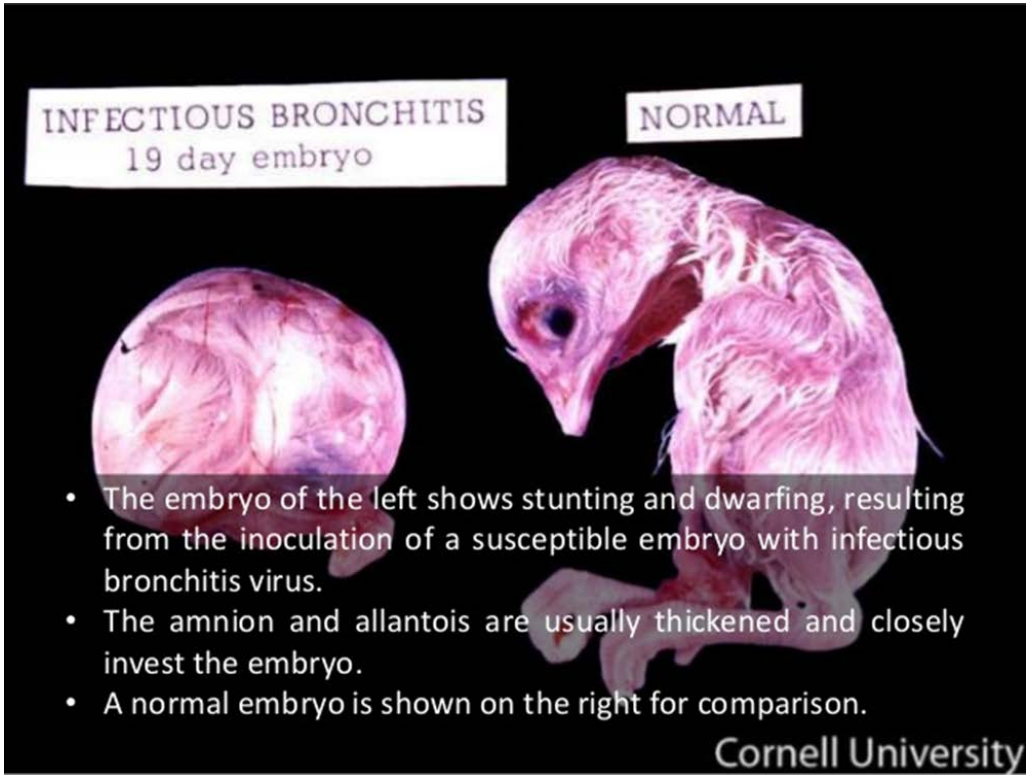
4-Pnemovirus infections and other more.

Often these diseases may present themselves in milder forms making it impossible to distinguish one from other.

What To Do

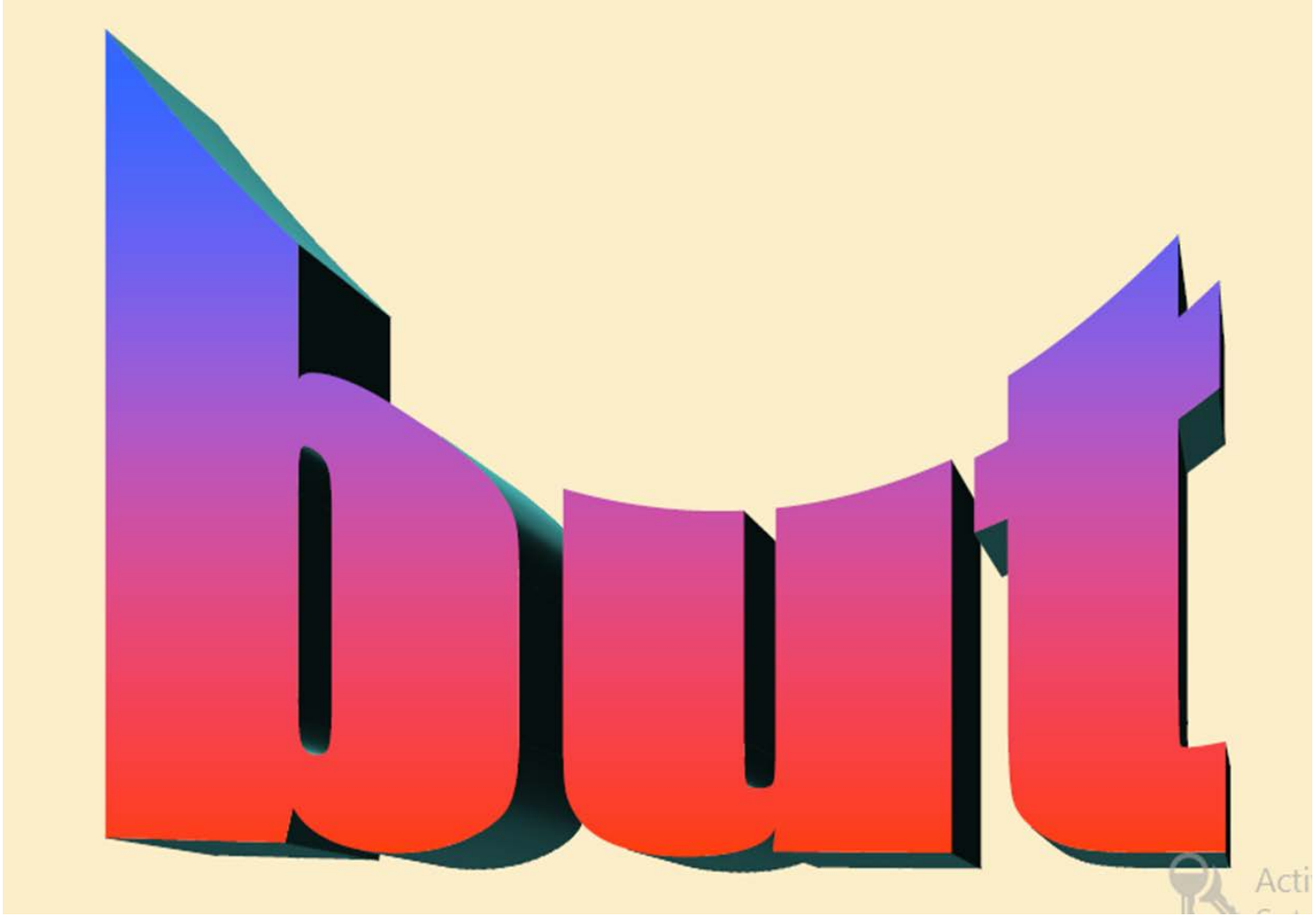
Diagnosis

Virus isolation is usually done in 9-10 day of age embryonated by using specific pathogen free (SPF) eggs. Several blind passages may be necessary before clinical signs characteristic of IBV are observed in embryos. Typical lesions in embryos occurring at about 5-7 days post inoculation, including curling and dwarfing of the embryos.



Also we can isolated the IBV on TC

Isolation



Problems related to isolation including

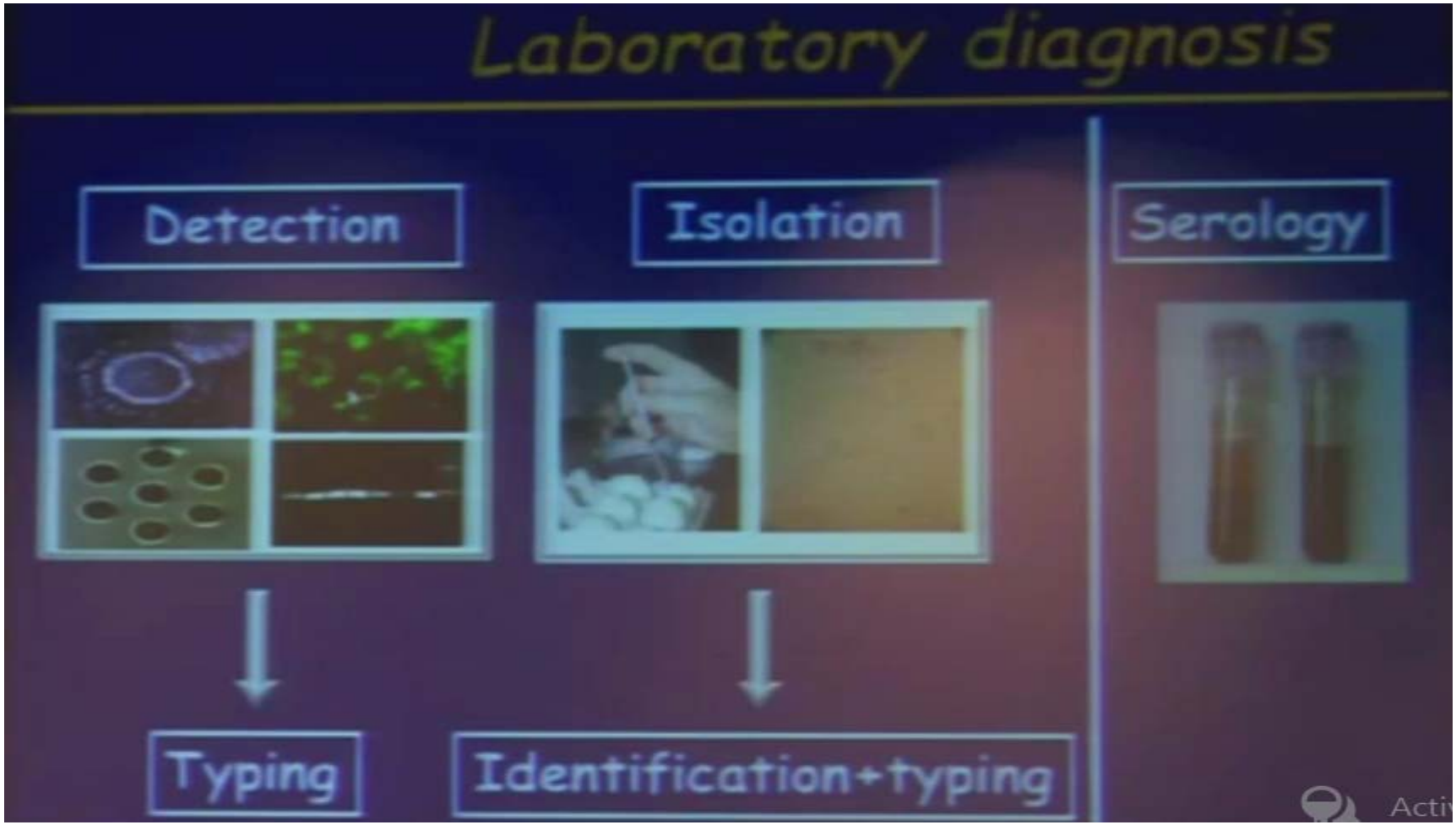
- Short duration of shedding
- Several passages are mostly required
- High cost

Laboratory diagnosis

Accurate Diagnosis

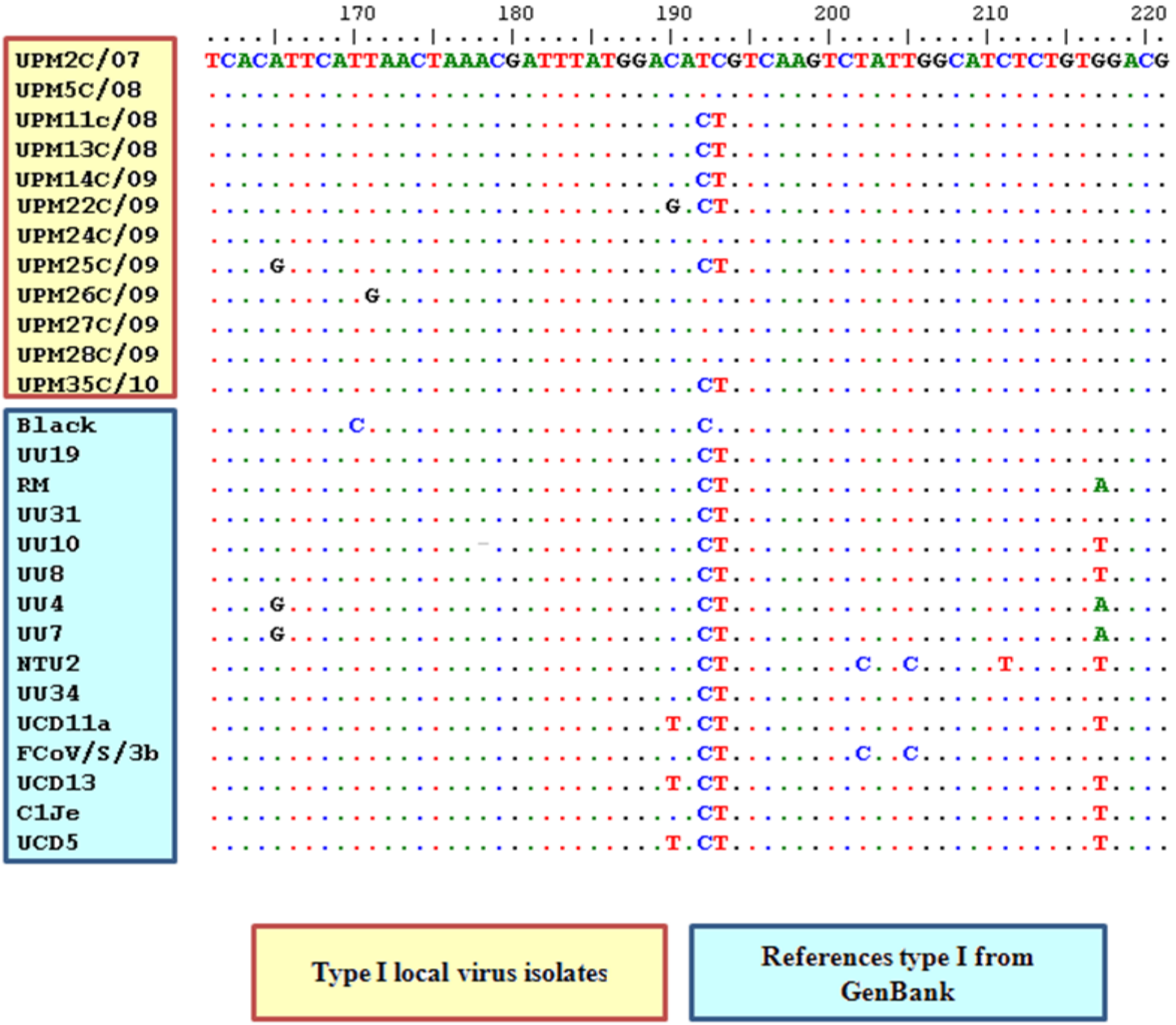
Diagnosis

Detection of IBV
using RT-PCR exhibited **higher sensitivity** than virus isolation and can be used as a rapid diagnostic method in the field, as well as in serotype differentiation and epidemiological studies.



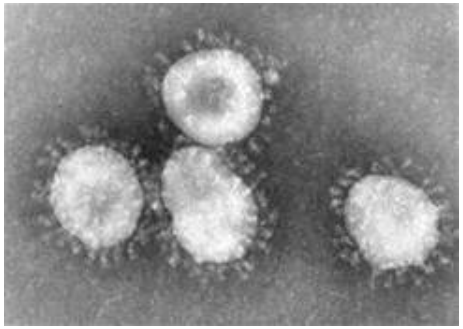
Virus Isolation- genome detection

Molecular typing of IBV is routinely conducted by sequence analysis of the spike glycoprotein gene. Typically the hypervariable regions of the spike gene, which are highly variable sequence regions that correlate with IBV serotype, by using RT-PCR amplified. The amplified product can be directly sequenced to determine the type of IBV in the sample. In addition, a BLAST or Basic Local Alignment Search Tool, can be used to find similar sequences in GenBank.

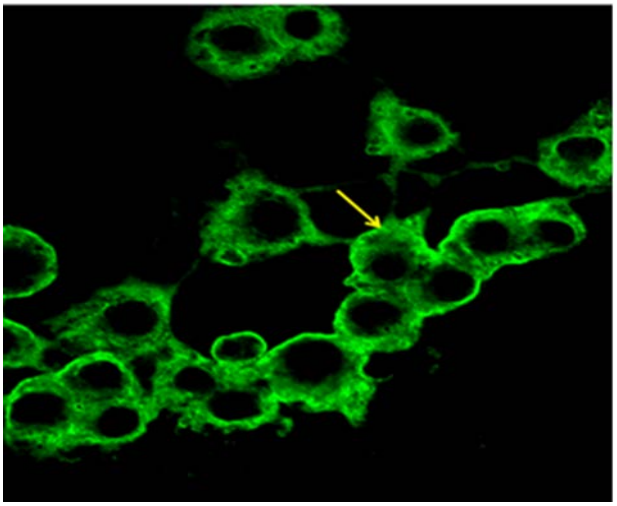

170
180
190
200
210
220
UPM2C/07
UPM5C/08
UPM11c/08
UPM13C/08
UPM14C/09
UPM22C/09
UPM24C/09
UPM25C/09
UPM26C/09
UPM27C/09
UPM28C/09
UPM35C/10
Black
UU19
RM
UU31
UU10
UU8
UU4
UU7
NTU2
UU34
UCD11a
FCoV/S/3b
UCD13
C1Je
UCD5
Type I local virus isolates
References type I from GenBank

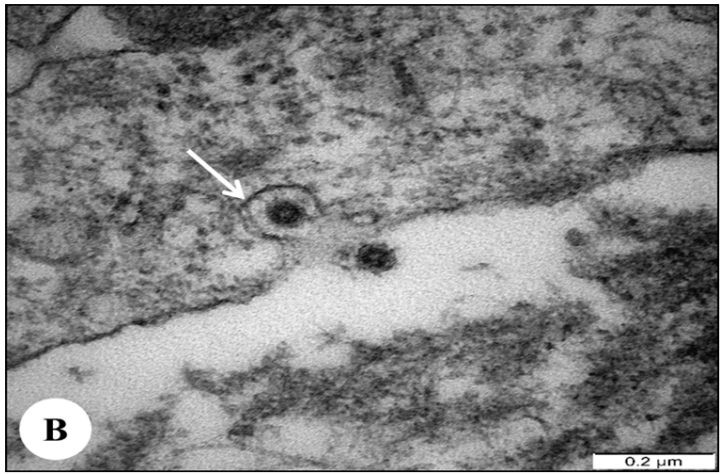
Suspected IBV Infection

By EM



By IF

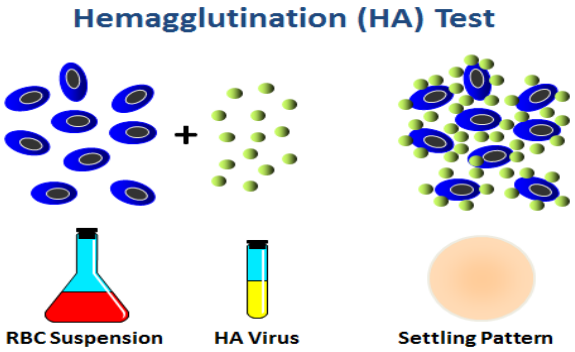


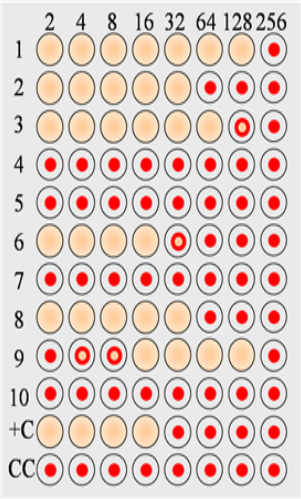


Diagnosis

Serological technique

Different serological tests can be used for viral antibody detection e.g. virus neutralisation test (VN), haemagglutination inhibition test (HI), enzyme-linked immunosorbant assay (ELISA).

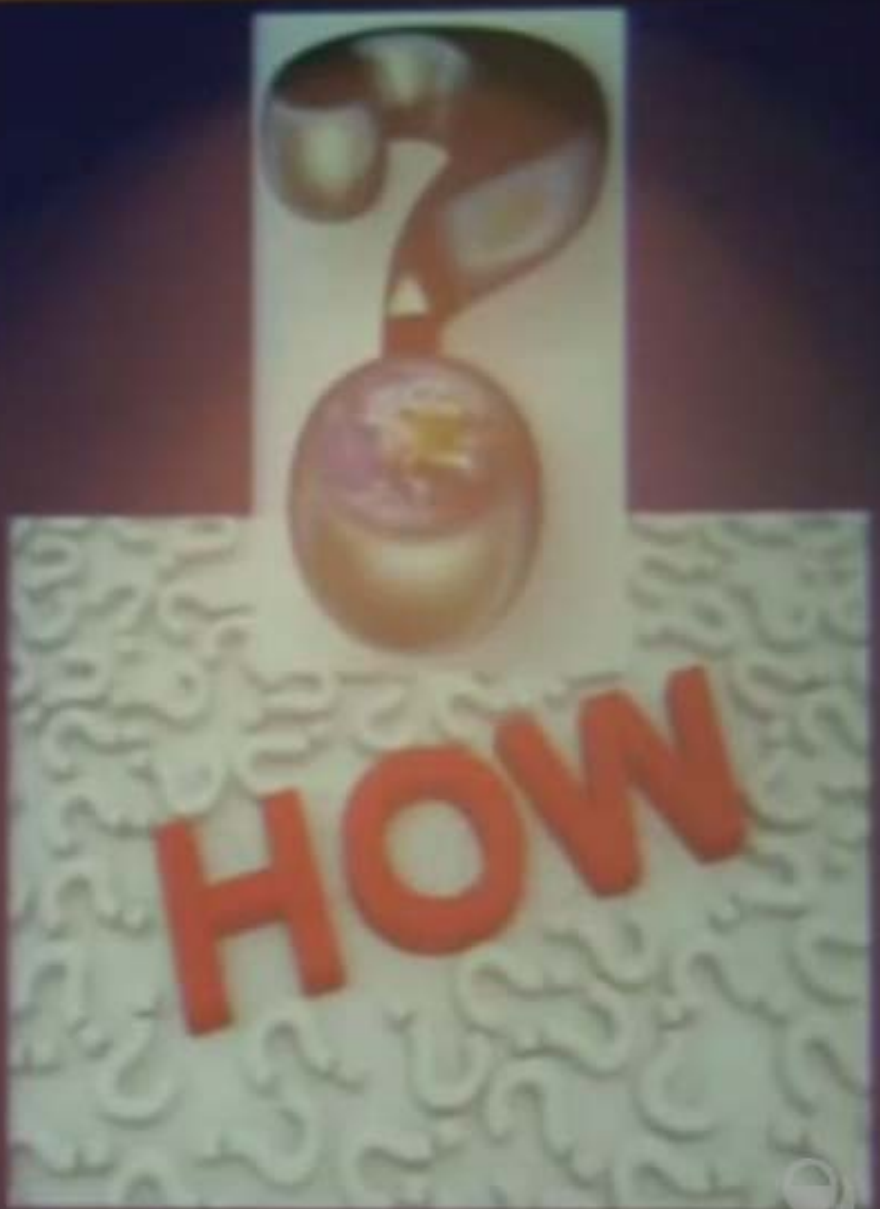




With the widespread use of the vaccines, serology has become of limited value.

Prevention and control of IBV

Disease Prevention and Control



Disease Prevention and Control

*- Biosecurity
*- Sanitation (C&D)
*- Monitoring & early detection

Disease Prevention and Control

Vaccination

Vaccines

Despite the widespread use of vaccines, IB continues to be one of the most economically important diseases of poultry worldwide

BECAUSE

The RNA-dependent RNA-polymerase present in in IBV, required for copying of the viral genome, is mainly responsible for the **extremely high mutation rate**. This enzyme does not have proofreading capability. So, when a mistake in copying the genome is made, the enzyme cannot go back and fix it. **This high mutation rate creates a diverse population of virus particles**. **This adaptation is evident clinically as variant viruses or emerging new serotypes of the virus**.

So, IBV continues to be one of the major pathogens of chickens throughout Europe

The control of IBV by vaccination is hampered because of the appearance of new emerging serotypes, which are **only weakly** affected by vaccination against the original serotypes. Although homologous live vaccines for IB are better than heterologous vaccines in controlling the disease, it is still recommended to develope the vaccines from different local strains to control IB.

Why is IB still a problem?

- ❖ Highly infectious
- ❖ Persistent in the birds
- ❖ Fast dissemination
- ❖ RNA virus - mutations
- ❖ recombinations

Causes different diseases

Many different serotypes

Generally, it is assumed that isolates with less than 89% similarity in this SI subunit belong to different serotypes.

An exception is the strains Conn 46 and Fla 18288 which have a similarity of 96% and belong to different serotypes, indicating that only a few changes in the right place are required to change the serotype.

So vaccination of bird flocks by one serotype protects the flocks poorly against infections by viruses of heterologous serotypes, which in turn reduces the efficacy of vaccination and makes it more difficult to control IBV .

Although effective vaccines are available and utilized routinely in commercial poultry production, the virus tends to mutate frequently. Little or no cross-protection occurs between different serotypes of infectious bronchitis virus , therefore, continuous determination of the epidemic serotype and production of new generations of vaccines are crucial for controlling IB in each geographic region or country.

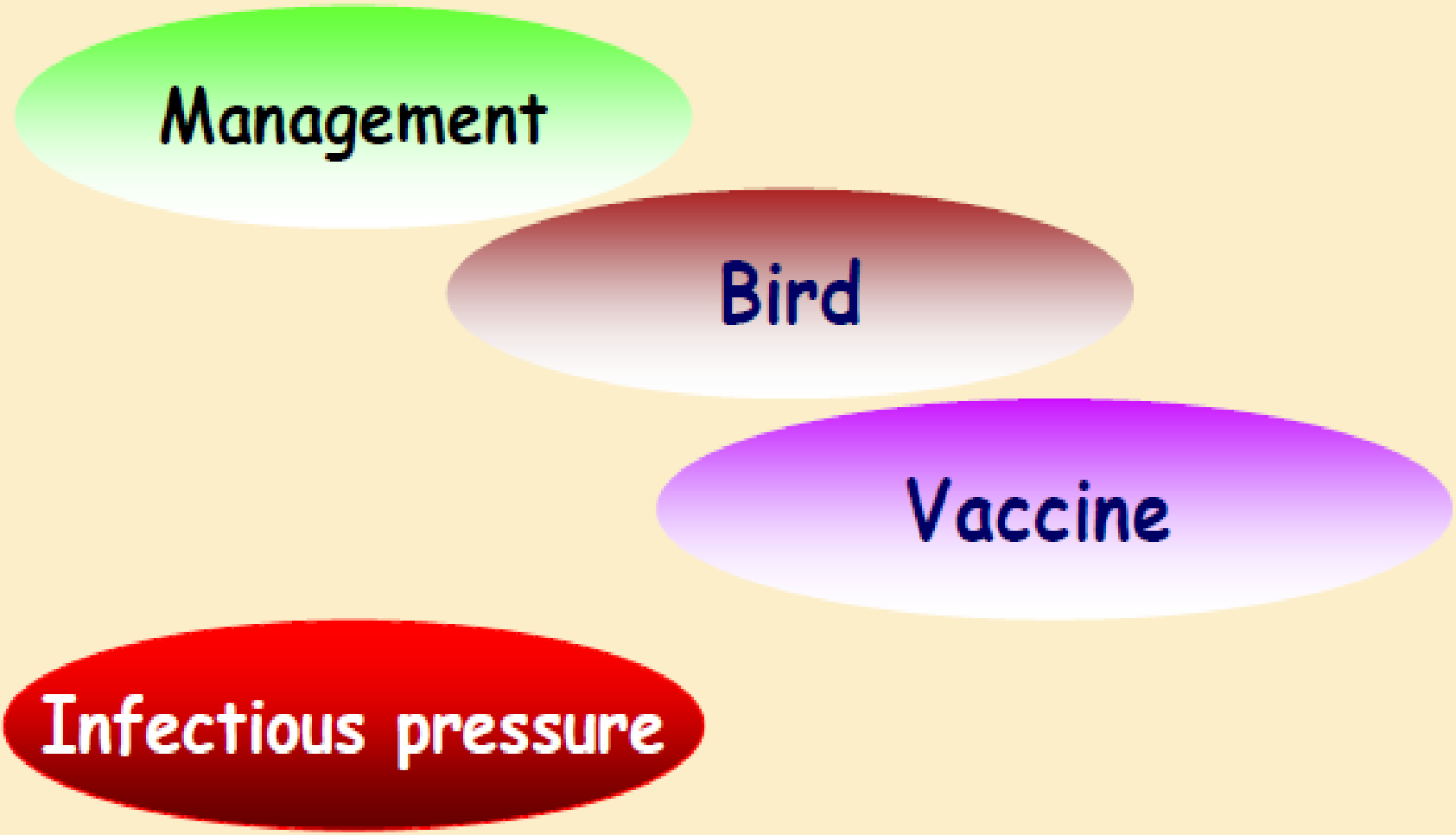
Live vaccine

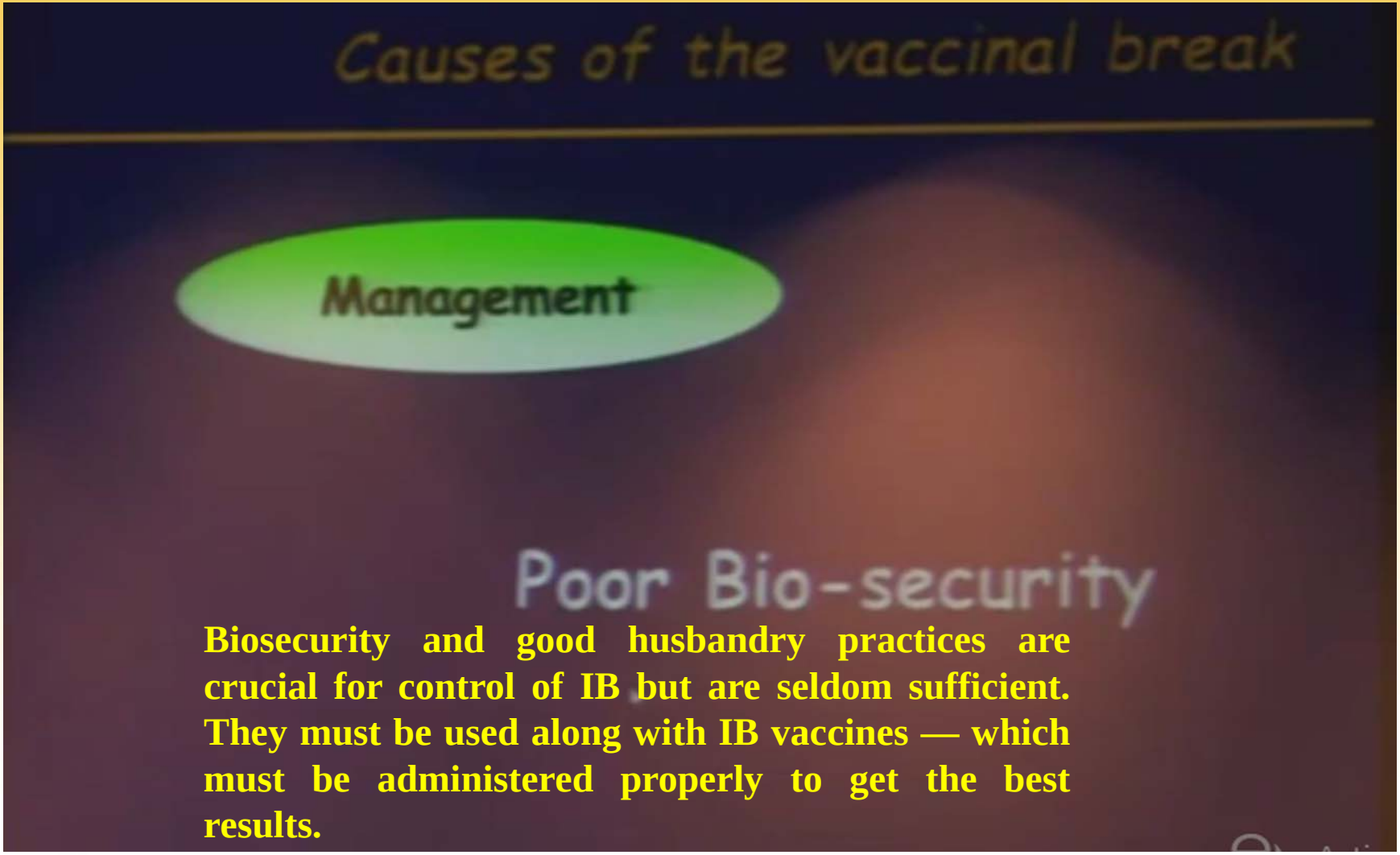
- ✓ **Replicated in the respiratory tract**
- ✓ **Stimulate local, humoral and cellular immunity**

Inactivated vaccine

- ❖ Need live vaccine priming
- ❖ Stimulate uniform and persistent titres

Causes of the vaccinal break





Biosecurity and good husbandry practices are crucial for control of IB but are seldom sufficient. They must be used along with IB vaccines — which must be administered properly to get the best results.

Bird Causes of the vaccinal break

*- Subclinical infections with other immunosuppression diseases (IBD, CAV, Mycotoxins)

*- Infection with field strain short before or after vaccination

*- Infection with (variant/mutant) strains?

Vaccine

Causes of the vaccinal break

Vaccine

Not correctly applied

Vaccine

Causes of the vaccinal breaks

Not include all serotypes "variants"

Virus mutation

Causes of the vaccinal breaks

In general, different serotypes of IBV do not cross-protect.

Causes of the vaccinal breaks

Some strains showed cross protection against other serotypes and consider as

protectotypes.

Vaccine

Causes of the vaccinal breaks

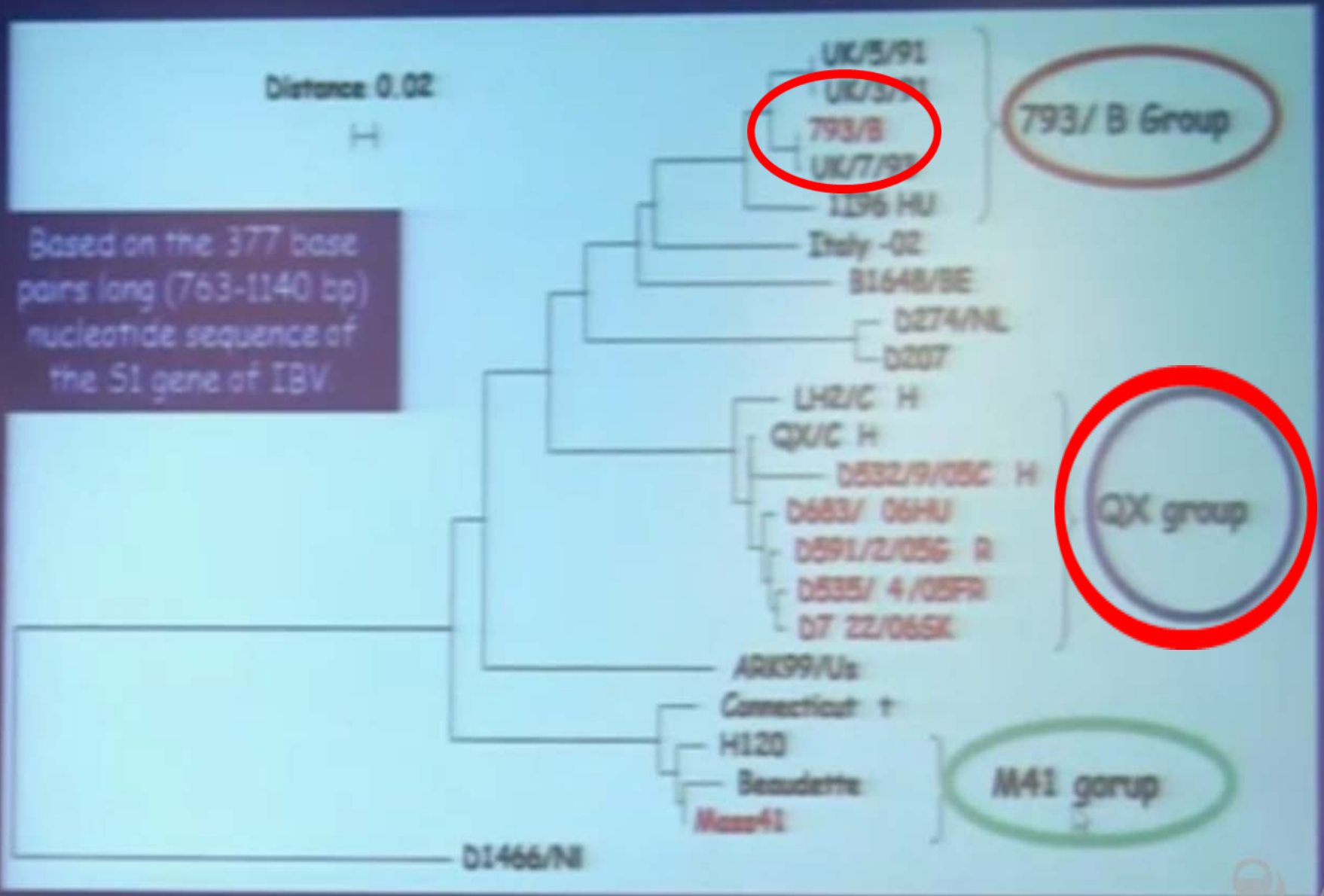
Protectotypes

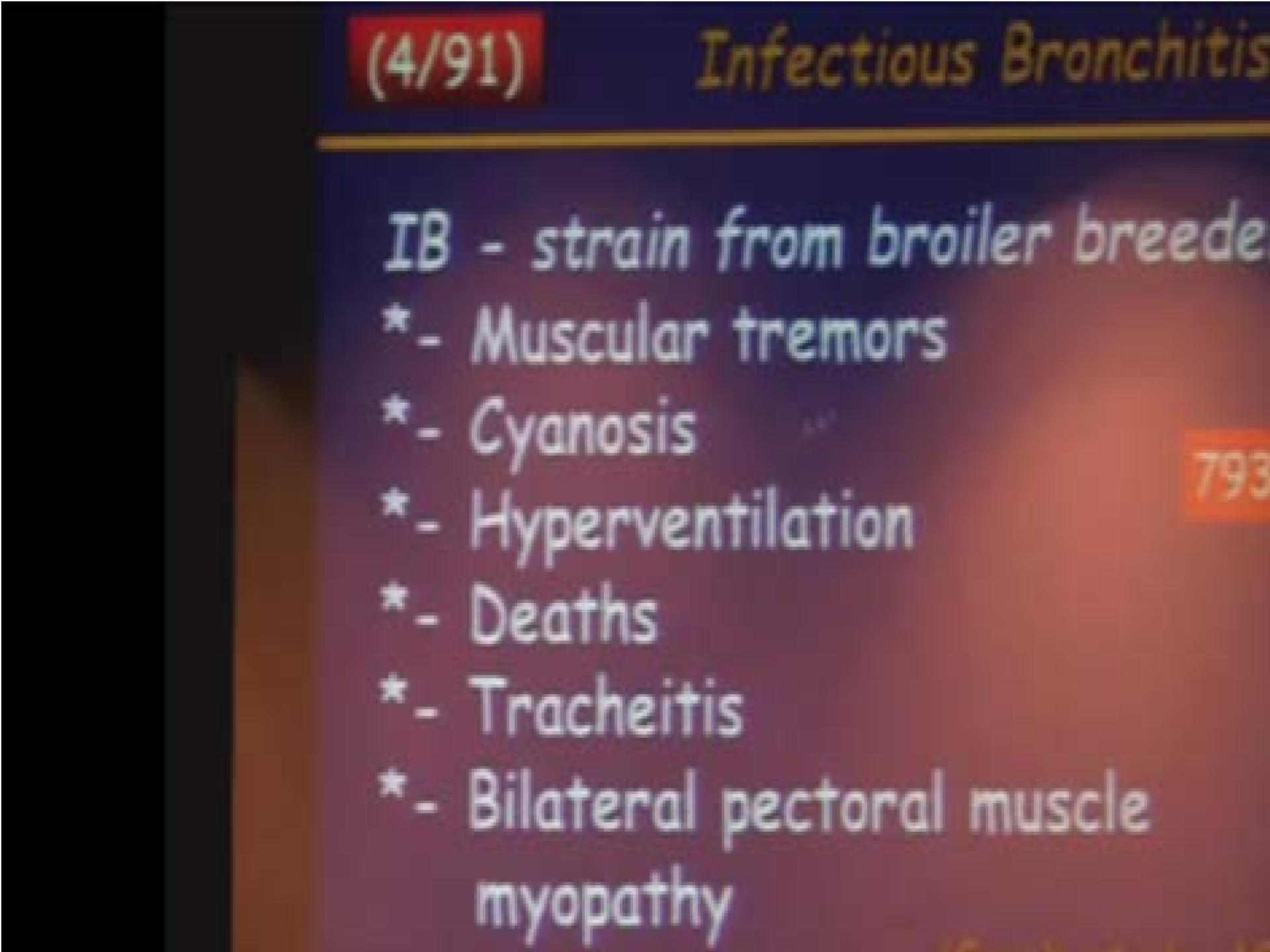
New serotypes may emerge as a result of few changes in amino acid sequence of the S1 gene of the virus spike and most of the genome remains unchanged.

Protectotypes

This may be the reason why the IB vaccines of a specific serotype can protect against other serotypes.

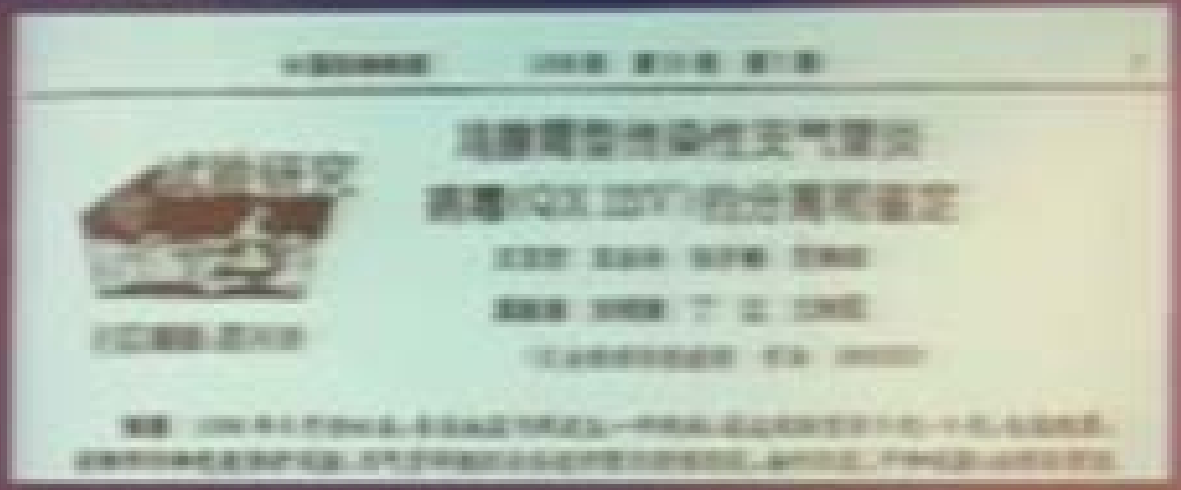
Phylogenetic tree of IBV strains




(4/91)
Infectious Bronchitis
IB - strain from broiler breede
*- Muscular tremors
*- Cyanosis
*- Hyperventilation
*- Deaths
*- Tracheitis
*- Bilateral pectoral muscle myopathy

(OX) Infectious Bronchitis

- QXIBV - China - Shandong province (1997/9
  Proventriculitis



- Respiratory distress, Proventriculitis, Nephri
  Nephrosis, Mortality, reproductive disorders
  "False layers", drop in egg production and re
  of egg quality

Detection of subtype 4/91 and QX IBV from 2004 to 2009

	2004	2005	2006	2007	2008	2009	Total
4/91	21%	35%	40%	36%	22%	12%	25%
QX	50%	34%	44%	51%	68%	60%	50%

- The percentage of 4/91 IBV varied between 40% in 2006 and 12% in 2009
- Since 2008 >60% of IBV positive samples were typed as QX IBV

*In some cases detection of 4/91 and QX IBV together with further IBV

Headache or tired ?

TO ALL WHO WORKS IN THIS FIELDS

Infectious bronchitis

- ❖ **Practical vaccination**
- ❖ **Schedule broiler**
  - ➢ **Bronzy medal…MA5 day one**
- ❖ **Silver medal**
- ❖ **MA5day one & day 14-18.**

Golden medal

IB Ma5 day old +Inactivated vaccine and IB 4/91 day 12-14.

This is broad protection

That the widespread nature of the IBV present in poultry flocks in Diyala province.

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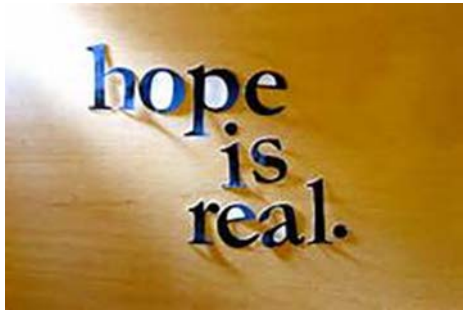

To Future work for isolation and serotyping of IBV in Diyala flocks, so that a suitable vaccine and vaccination program adapted by using the common filed serotypes as vaccines to protect against IBV.

In conclusion the increasing prevalence of new serotypes creates difficulties in the design of adequate vaccination programs against IBV & it is undesirable and not always necessary to consider developing new live vaccines for each new serotypes.

Extensive clinical experience and laboratory studies have shown that vaccination with two or more different live attenuated IBV vaccines confers a **broad protection** against many important heterologous serotypes.

Some IB virus serotypes are able to cross-protect against other IB serotypes; these have become known as **Protectotypes.** There's a reason for this. New IB variants can arise due to very small changes in the makeup of the IB virus, but the rest of the virus' genetic makeup remains the same. This is why some cross-protection is thought to occur. An example of a Protectotype protocol is one featuring the live vaccines Nobilis IB Ma5 and Nobilis IB 4/91. The Ma5 vaccine is based on the classical Massachusetts IB virus serotype, while the 4/91 vaccine is based on the 4/91 IB variant serotype. Used together, they can provide broad protection against an IB challenge.


Thank you!
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