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Important Diseases in the modern Layer Industry

Diseases of Poultry

Contents

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Important diseases in US

Rank	Caged layer		Cage free layers	
	Prevalence	**Importance**	**Prevalence**	**Importance**
1	Escherichia coli /1.91	Eschericia Coli /2.17	Cannibalism / 2.19	Escherichia Coli / 2.29
2	Mycoplasma Synoviae /1.65	Mycoplasma gallisepticum / 1.87	Escherichia coli / 2.10	Cannibalism /2.24
3	Mycoplasma galllisepticum/ 1.48	IBV & Cannibalism / 1.65	Ascarids / 1.67	vILT & Mg / 1.86

AVEP 2017 Layer health survey

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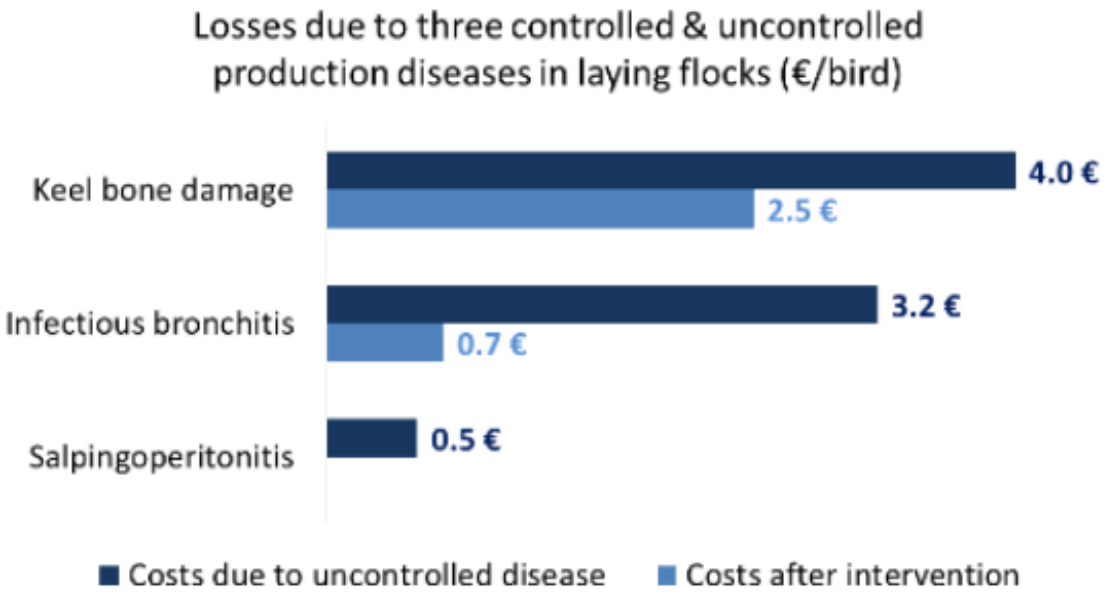
Important diseases in EU



PROHEALTH

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Which of this diseases are concerning you more?

1. Avian Influenza
2. Newcastle Disease
3. Infectious Bronquitis
4. Mycoplasma
5. Red Mite
6. Salmonella gallinarum
7. Infectious Laringotracheitis
8. Marek Disease
9. Spotty Liver Disease
10. Fowl Cholera
11. Gumboro Disease
12. I don’t care

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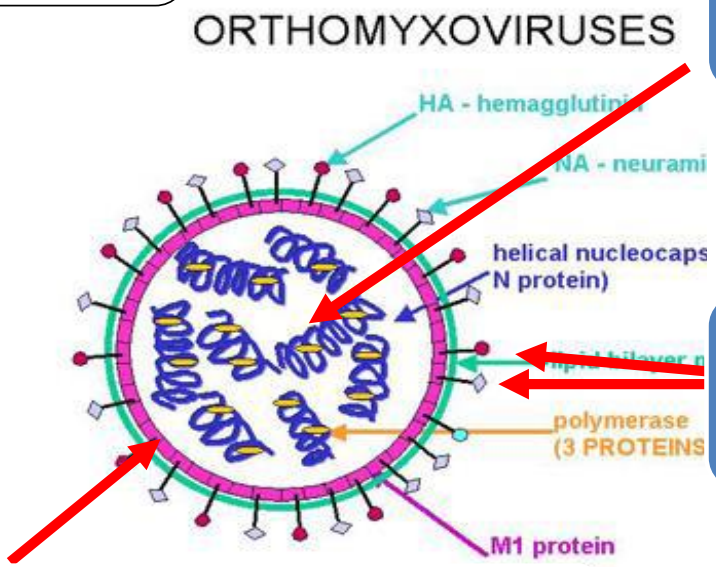
Avian influenza

AI VIRUS

Main strategy:
CONSTANT
EVOLUTION



8 segments of single-stranded, negative-sense RNA:

- High mutation rate (RNA)
- High recombination capacity (8 segments)

2 main surface proteins:

- Hemoaglutinase (1 - 16). Highly related to the pathogenicity.
  - H5 H7: normally High pathogenic
  - All the other: low pathogenic
- Neuronidase (1 -9)

Lipid Envelope

- Relatively unstable in the enviroment
- Sensible to heat, pH, dryness, detergent and chemical disinfectant
- High survival capacity in water

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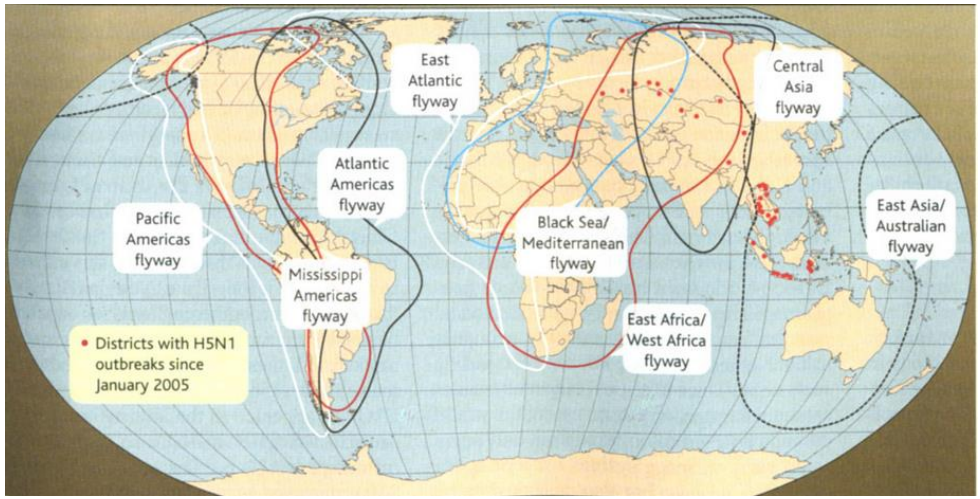
AI RESERVOIR & SPREAD



- **Wild aquatic birds**
- **Majority are represented by two Orders**
  - **Anseriformes (ducks, geese, and swans)**
  - **Charadriiformes (gulls, terns and shorebirds)**

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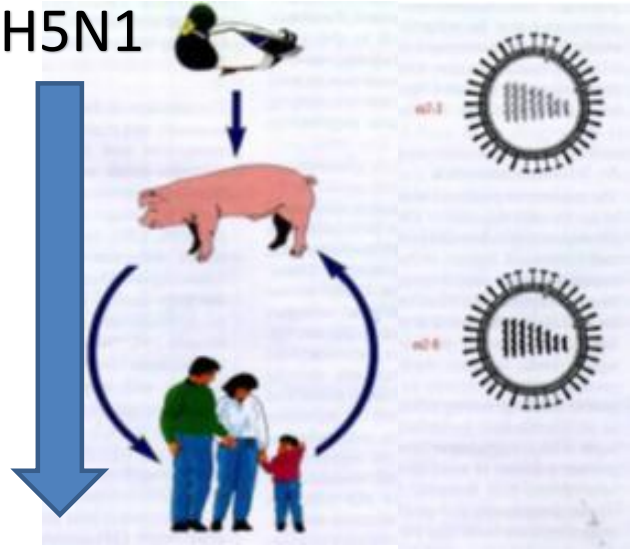
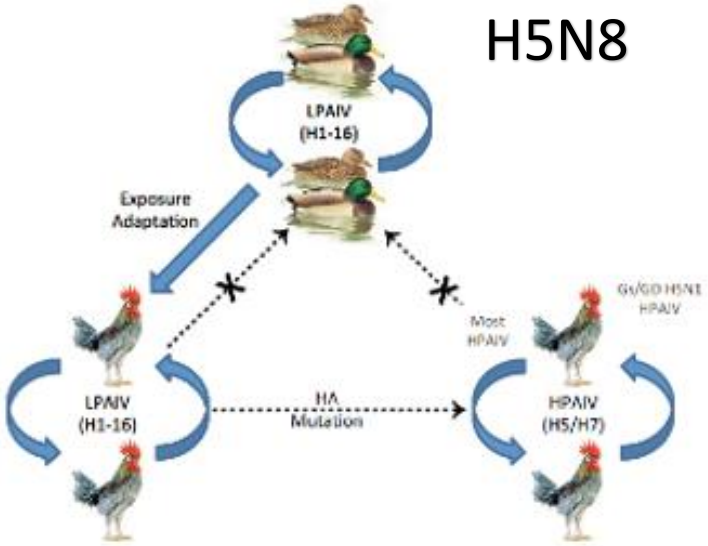
AI ECOLOGY

H5N1



H5N8



Hemagglutinin (H) Subtypes:

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Human	●	●	●		±		±		±							
Equine			●				●									
Swine	●		●	±	±				±							
Avian	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

Neuraminidase (N) Subtypes:

	1	2	3	4	5	6	7	8	9
Human	●	●					±		
Equine							●	●	
Swine	●	●				±			
Avian	●	●	●	●	●	●	●	●	●

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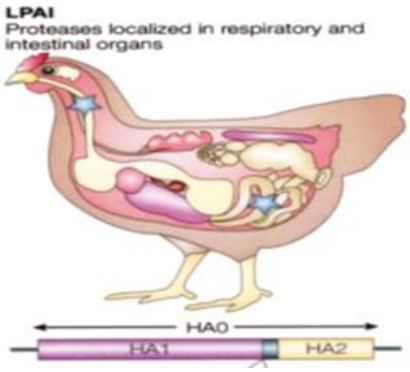
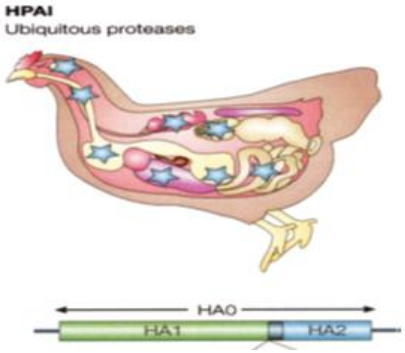
LPAI VS HPAI





HA	H1-H16	Only H5 & H7
Infection	Only in respiratory and intestinal gut	Systemic
Clinical signs	• High morbidity (>50%) and low mortality (<5%). • Mild respiratory signs with lethargy, decreased consumption. Bird in production: - Egg lay drop (10-50%) - Decreased egg quality	• Acute disease, Very high mortality rates(100%). • Multiorgan failure. • Birds in Egg production - Decreased or cessation of egg production - Decreased egg quality

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HPAI LESION

Spectacular lesion but laboratory analysis needed to confirm diagnostic

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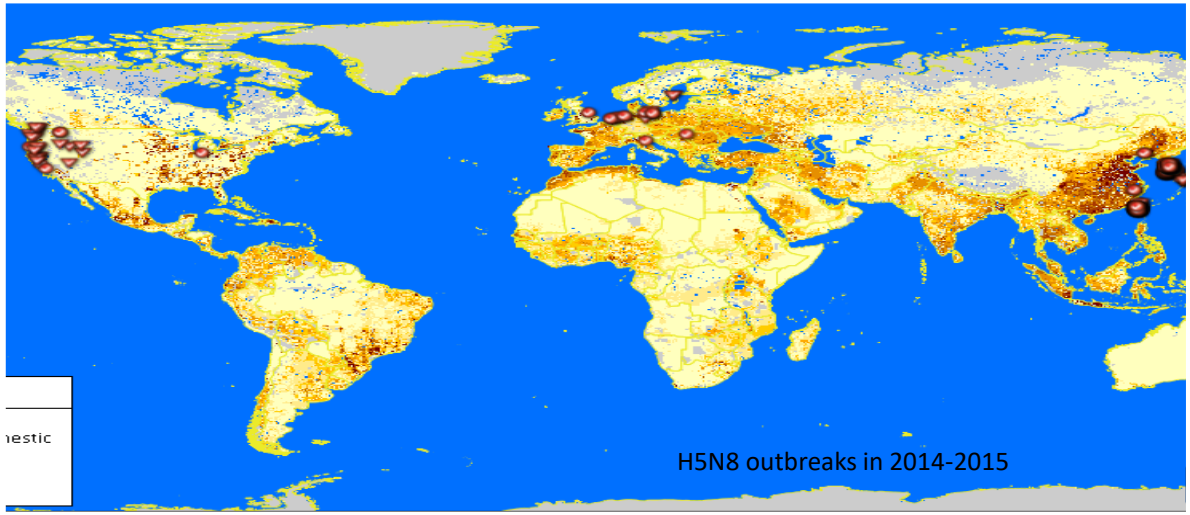
H5N8 HPAI

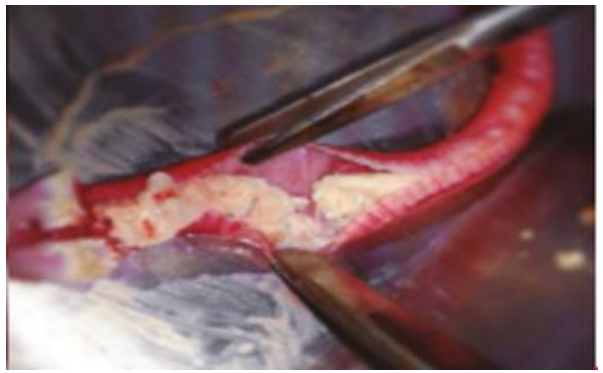


- The first outbreak report in domestic ducks was in South Korea on January 2014
- In Europe, the first affected holding was reported on the 4 November 2014 in the Mecklenburg-Vorpommern (Germany)
- To date, there have been no reports of human cases
- Highly pathogenic even for ducks and wild birds

LPAI H9N2

H9N2 LPAI

- Presence in North Africa, Middle East and Asia. Presence in Morocco since 2016
- Low pathogenicity strain but strong impact in birds:
  - Breeders:
    - Flocks from 1 to 5 weeks old: High mortality
    - Flocks in production:
      - Mortality: 8-9%
      - Egg production drop: 30-70%
      - Fertility drop: 6%-10%
- Vaccination protect against clinical signs but not avoid disease spreading



AI CONTROL

- **1.** Education
- **2.** Biosecurity
- **3.** Diagnostics and Surveillance
- **4.** Elimination of infected poultry (stamping-out)
- **5.** Decreasing host susceptibility (immunity against AIV):
  - Vaccination
  - Maternally derived antibodies (MDA)

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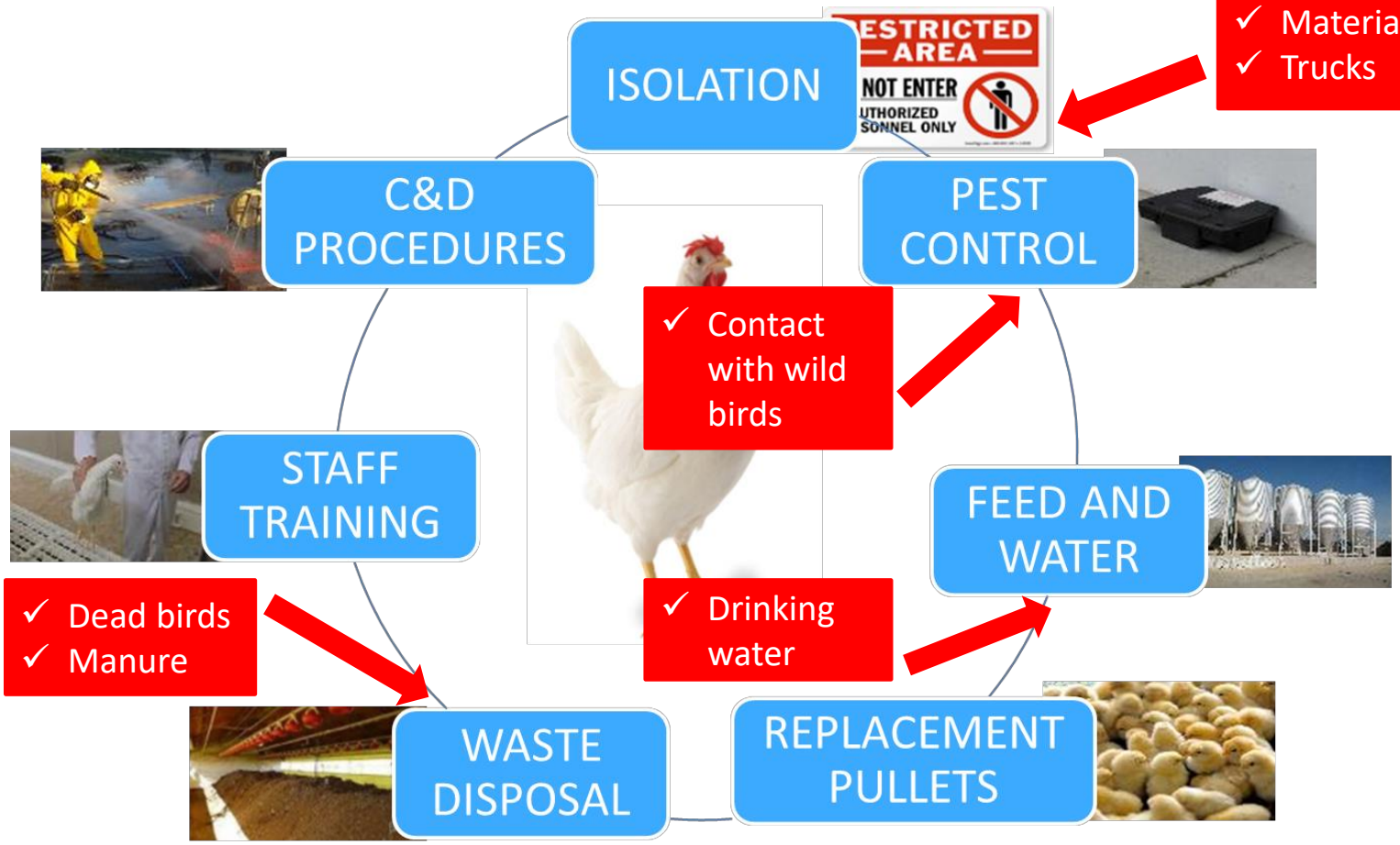
BIOSECURITY



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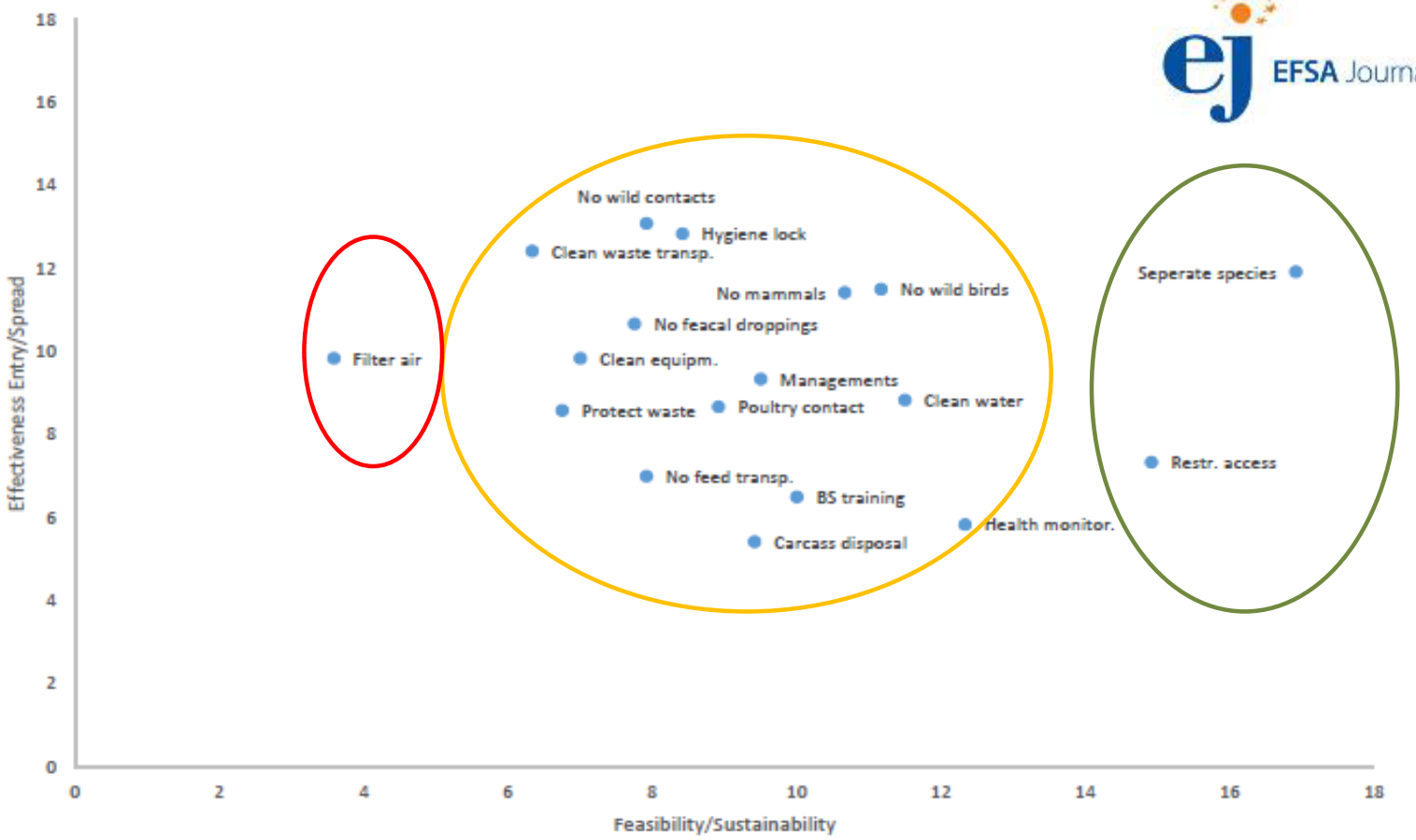
BIOSECURITY

Average ranking criteria for the Production Zone



AI DIAGNOSTIC

- Outbreak confirmation
  - PCR
  - Virology

- Surveillance program
  - Serology

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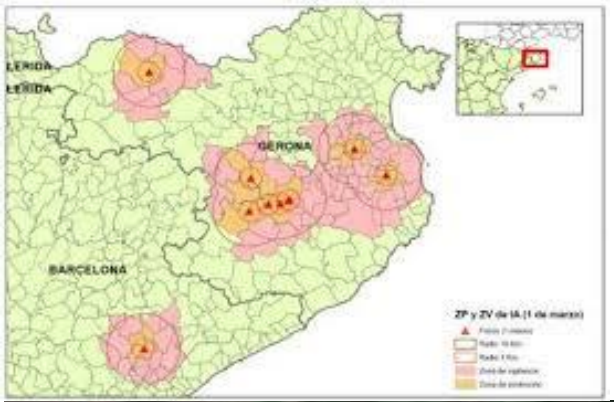
STAMPING OUT

- Avoid further infected farms
  - Protection zone
  - Vigilance zone
- Complete depopulation & carcasses destruction
- Special C&D and repopulation protocol



TIME IS CRUCIAL → LOGISITIC IS A REAL CHALLENGE

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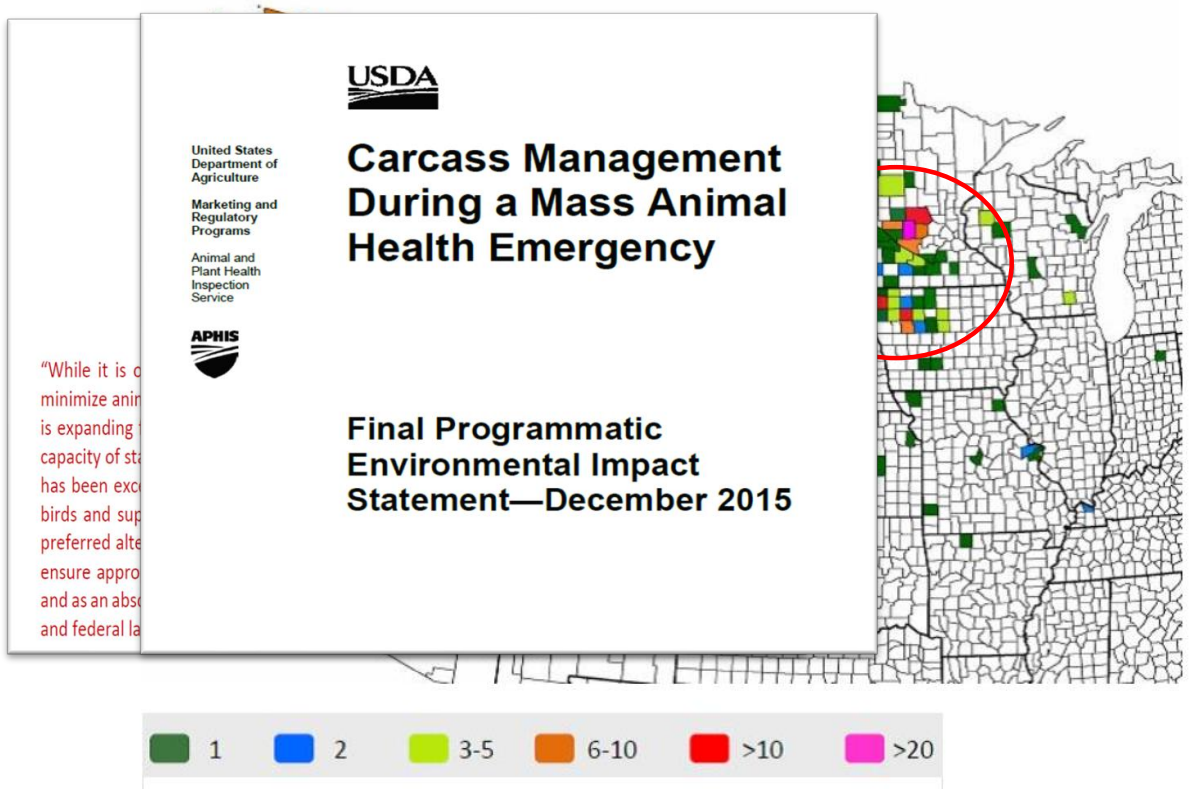
STAMPING OUT

2014-2015 H5N2 outbreak in EEUU



42 million layers
7.5 million turkeys

VACCINATION

STRENGTH	WEAKNESS
• Increase resistance to AIV • infection • Reduce replication of AIV in respiratory & GI tract • Prevent illness and death in poultry • Reduce transmission to birds and humans	• Do not prevent infection • Do not prevent shedding • Protect only from field viruses within the same hemagglutinin subtype • Make monitoring much more complicated (DIVA)

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VACCINATION

- AI vaccines
  - Oil-emulsified inactivated whole AIV
  - Recombinant live virus vectors with AI HA gene insert
- AI vaccination program
  - Specific prime 2 doses protocols as minimum
  - Long life birds should be re vaccinated for maintaining protective immunity (each 6 months?)
  - Targeted population
    - High risk production (Free-range ducks, …)
    - Ring vaccination zone after outbreak
    - Routine

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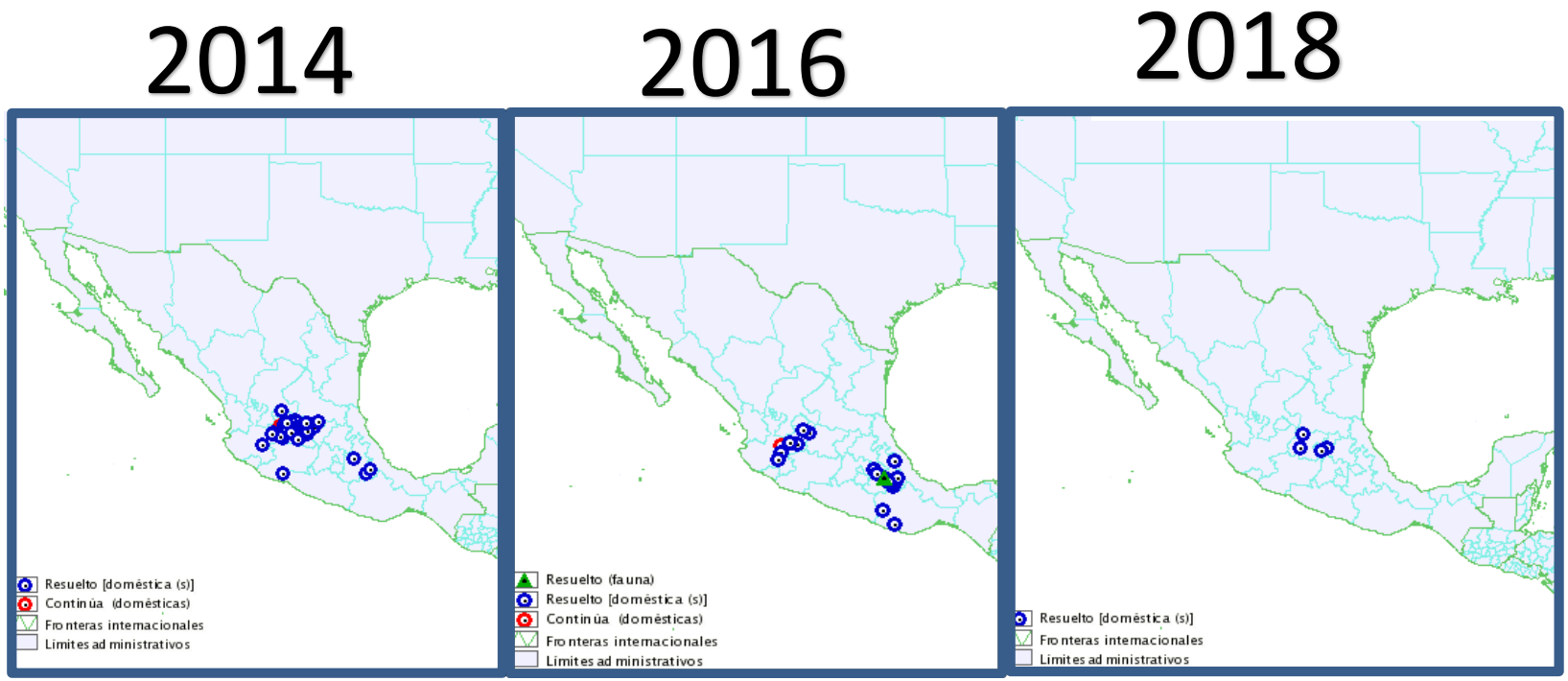
VACCINATION



- Mexico
  - Routine H7 vaccination
  - Still outbreak almost every year

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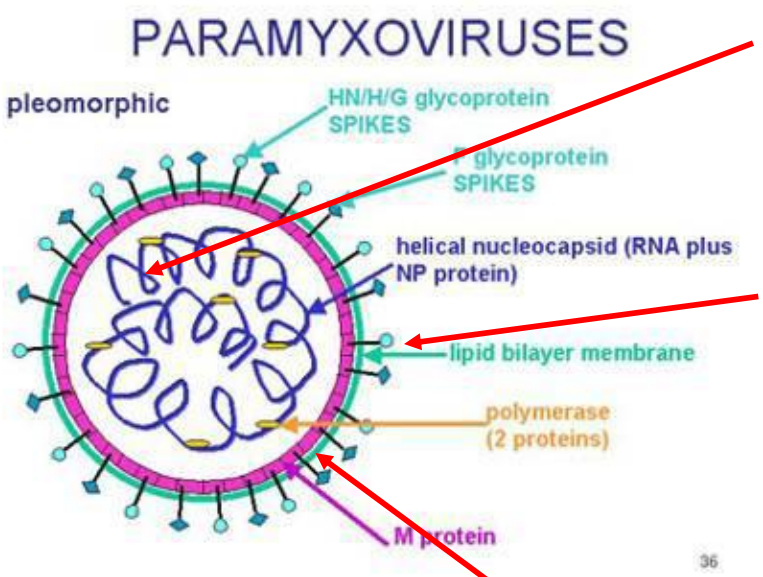
NEWCASTLE DISEASE

ND VIRUS



1 segments of single-stranded, negative-sense RNA:

- More stable virus!!!

1 main surface protein1 (H/N):

- Less antigenic variability
- Only one serotype

Enveloped virus by a lipid bylayer

- Relatively unstable in the enviroment
- Sensible to heat, pH, dryness, detergent and chemical disinfectant

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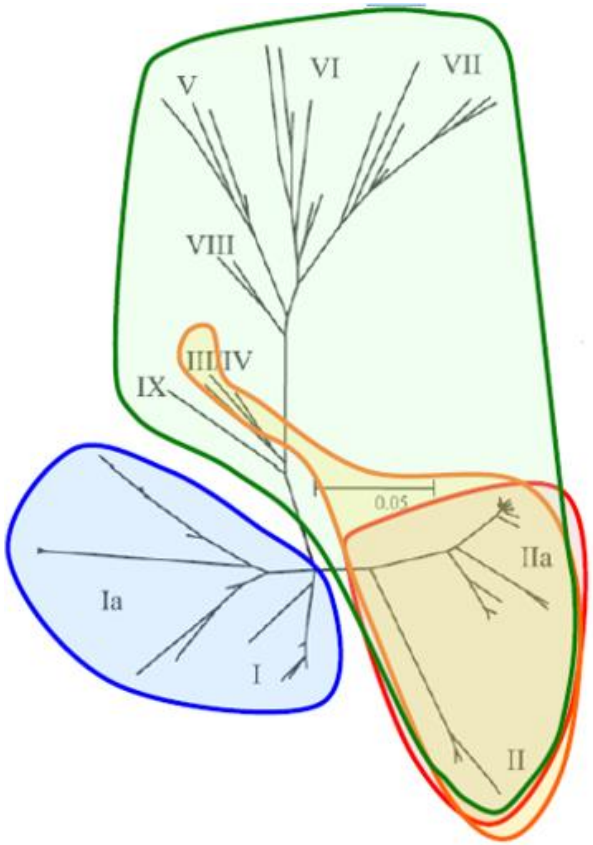
Classification of NDV strains



Source: T Van der Berg

- **Velogenic** (in green): Until 80% mortality
  - Neurotropic (II)
  - Viscerotropic (III-IX)
- **Mesogenic** (in orange) Until 10% mortality. Respiratory sign
- **Lentogenic** (in red) Mild or inapparent respiratory sign
- **Apathogenic** (in blue)

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ND CLINICAL SIGNS AND LESION

- Drop in egg production
- Edema of head, especially around eyes
- Greenish-dark watery diarrhea
- Respiratory and neurological signs

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ND Control

- BIOSECURITY
  - Same programs as in AI
  - Pay attention to dead birds and manure
- VACCINATION
  - Good immunity will protect against the clinical sign and shedding
  - Live and inactivated vaccines available
  - One serotype (?)

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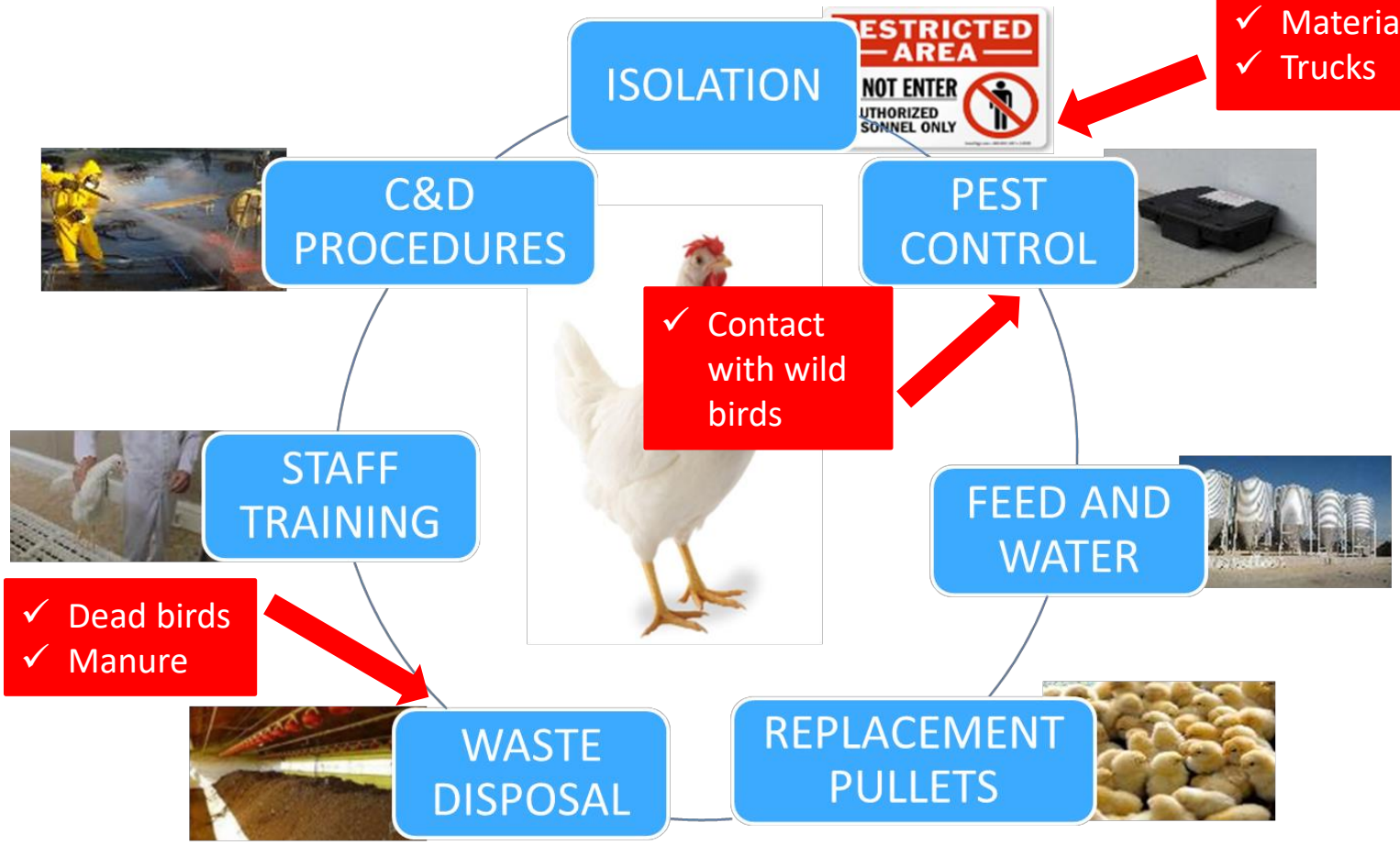
BIOSECURITY



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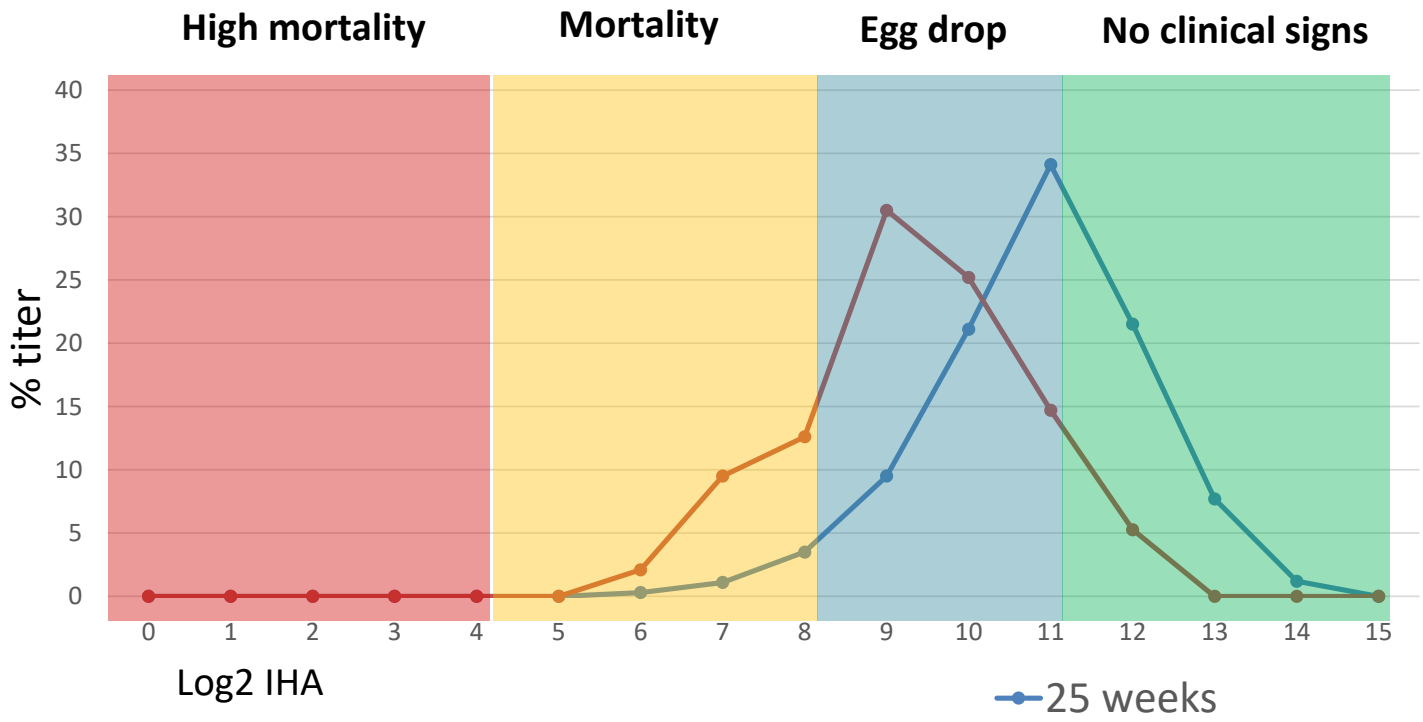
Vacination

Antibody titers against ND after vaccination program
(2 live vaccines + 1 inactivated vaccine in rearing.
No vaccination in production)



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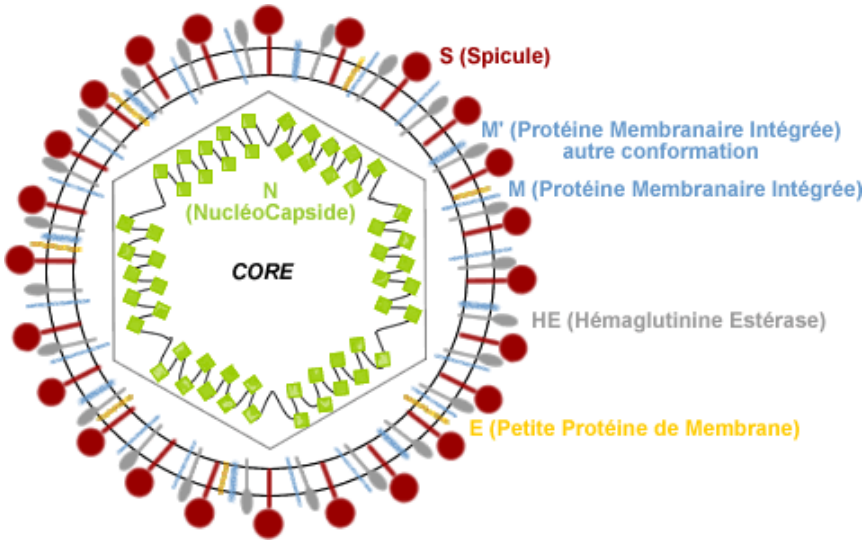
INFECTIOUS BRONCHITIS

Infectious bronchitis



- A coronavirus; single- stranded RNA virus
- Worldwide importance
- Huge capacity to mutate. Therefore able to change continually by:
  - random mutation
  - genetic recombination
- A highly infectious disease of chickens of all ages and type

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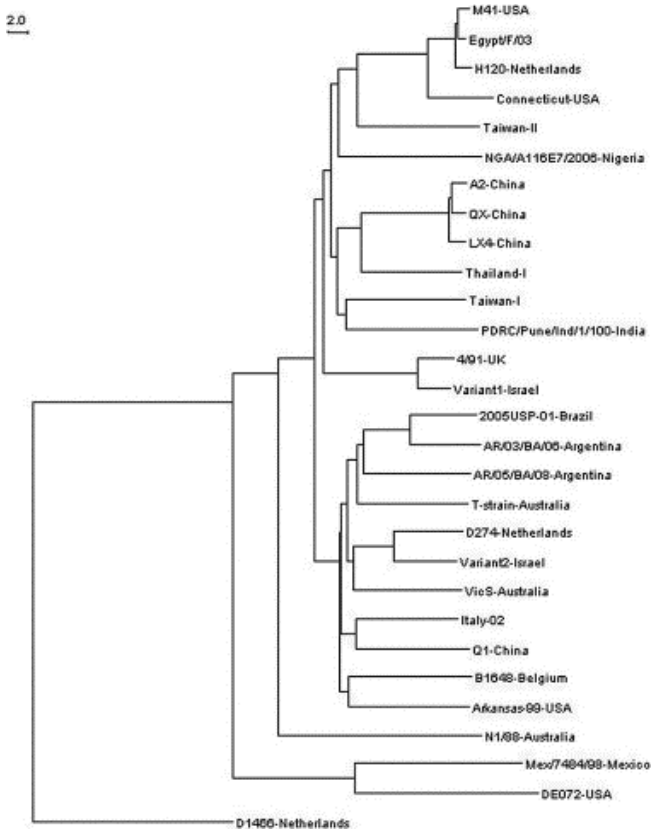
IB SPREAD

- Transmission of IBV:
  - Highly infectious
  - Spread by aerosol and faeces
  - May persists in the chicken for many weeks
  - May survive in litter for many days •

IB VARIANTS



- Result from mutation or genetic mutation
- A new variant is recognised in the laboratory by:
  - Serotyping (traditional method)
  - Genotyping (increasingly used)
- Different pathotypes

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IB CLINICAL SIGN & LESIONS

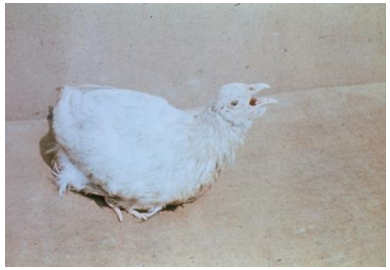
1. Primary infection site – upper respiratory tract

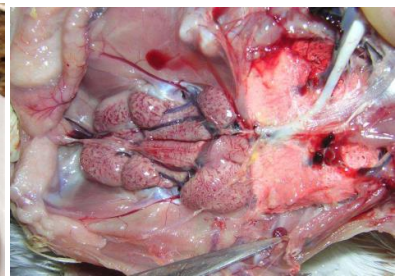
1-21 days

Early infection:
- Hidroponic oviduct

> 21 days

Late infection:
- respiratory disease
- nephropathogenic
- alteration of the reproductive organs





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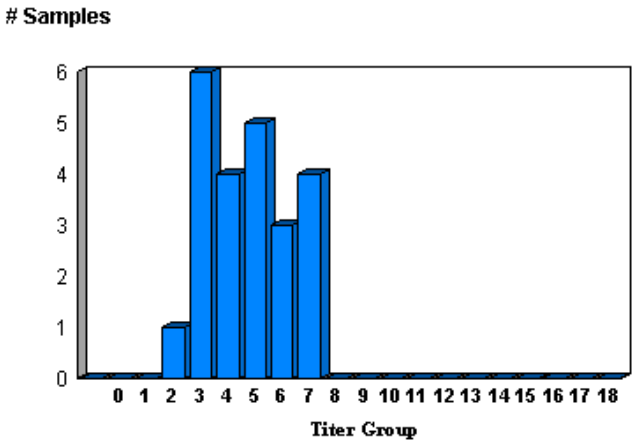
IB DIAGNOSTIC

Diagnosis:

- Virus isolation in embryo culture
- PCR
- Antibody detection:
  - AGP and ELISA: group specific
  - HI and SN: serotype specific



Assay :	IBV	**Lot:**	FS4918
Bleeding Date :	25-08-2009	**Testing Date:**	25-08-2009

Mean Titer:	5 297		
Min. - Max Titer :	2 939	-	9 863
G.M.T.:	4 985		
%CV :	37		
Target Titer:	**1 000**	-	**2 000**
Target %CV:	**40**	-	**70**
VI Index:	**143**		
VI Target Range:	**10**	-	**90**
Interpretation VI Index:	**HIGH**		

Details Vaccination Program:

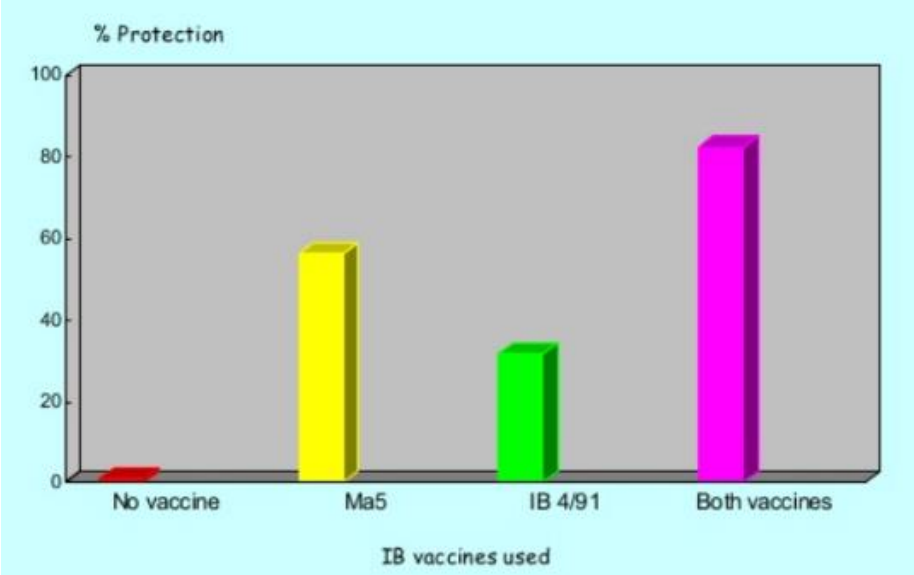
Vaccine	Method	Age	Vacc.Batch/Applicator
H120	SPRAY	01D	
H120	DR. WATER	09D	/

Titer Range Ref. Controls:	CR (4500-8000) ; F1 (1000-4000) ; R8 (2000-6000)
Mean Titer Ref. Controls:	CR= 6301 ; F1= 1766 ; R8= 4334

IB CONTROL

- BIOSECURITY
  - Corner stone but not enough!!!
- VACCINATION
  - Live and inactivated vaccines available
    - 2 or 3 live vaccines + inactivated vaccine
    - Use different strains if available → protectotype
    - Protect chicks from day 1 !!!

PROTECT TYPE CONCEPT



Source: J. Cook

- Use two or more highly immunogenic and not related vaccines
- Variant vaccine are said to provide a better protection against similar field virus
- BUT real protection is only know after lab or field trials

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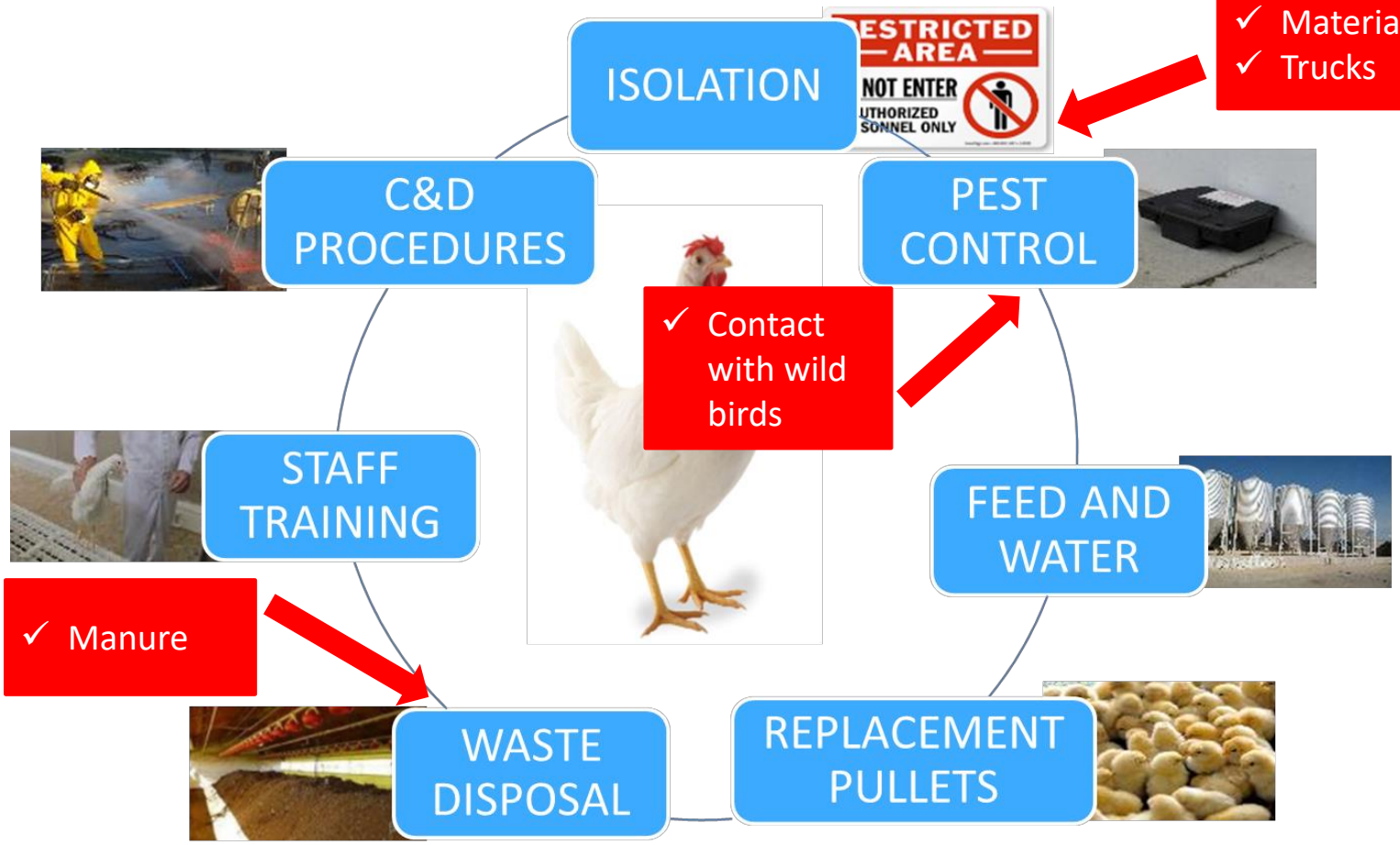
BIOSECURITY



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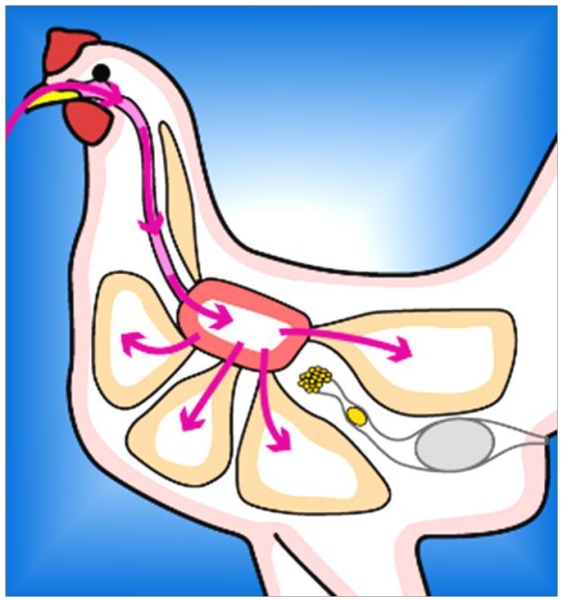
MYCOPLASMOSES

Mycoplasma gallisepticum

- Class mollicutes (No wall)
- Extremely resistant in the host.
- Very unstable in the enviroment
- Typically associated with CRD in laying hens with another virus or bacterias (E. Coli)

MG SPREAD



- Vertical transmission can also occur in eggs laid by infected hens
- Pulsatile excretion

Cotton: 4 days
Feathers: 4 days
Hair: 3 days
Straw: 2 days
Rubber: 2 days
Nose: 1 day
Wood: 1 day
Shavings: 8 hrs
Feed: 4 hrs
Ear: 4 hrs
Skin: <4 hrs

The route of infection is through the upper respiratory tract and/or conjunctiva

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MG CLINICAL SIGN & LESION

- Drop in production
- Egg shell thickening
- Depression
- Rales, Coughing, Sneezing, Nasal discharges

MG CONTROL

- BIOSECURITY
  - PS should be remain uninfected
  - Biosecurity level should be improved
- VACCINATION
  - Live and inactivated vaccines available
- ANTIBIOTHERAPY
  - MG is sensible to many AB (Tetracyclines, macrolides, …)
  - AB treatment will decrease clinical sign for a time
  - Infected bird WILL continue as carrier in spite of AB treatment

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MG Vaccines

	Ability to Spread	Antibody response	Pathogenic to turkeys	Route of Administration
Bacterins	No	+++	No	Injection
F-strain	Yes	++	Yes	Spray/Eyedrop
6 / 85	No	-	No	Fine spray
TS - 11	No	+	No	Eyedrop

Source: A. Mazaheri

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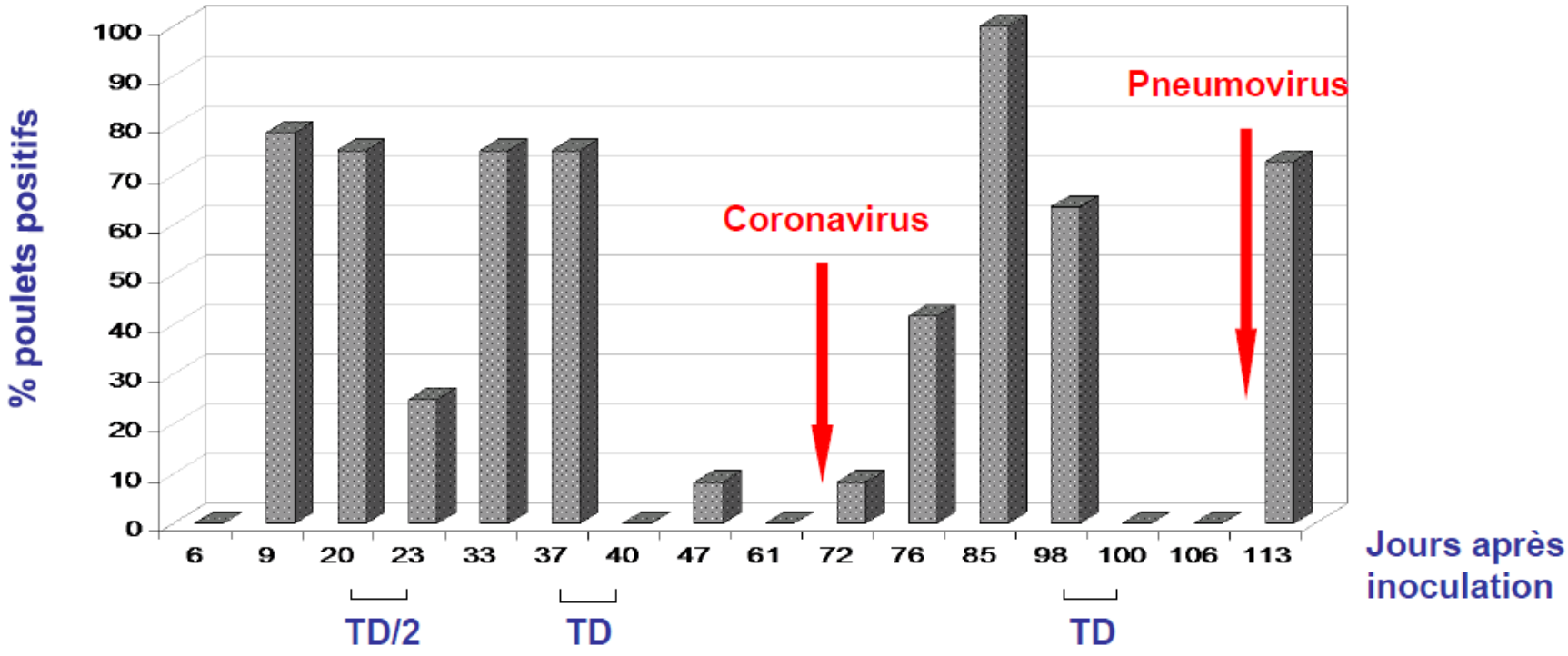
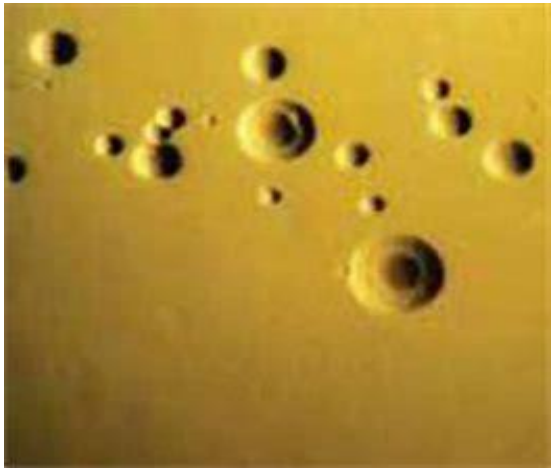
Antibiotic treatments



Source: ANSES

MYCOPLASMA SYNOVIAE



- Causes infectious synovitis and respiratory disease
- Pathogenicity depending on the virulence ant tropism:
  - Strain apathogenic alone
  - Strain affecting respiratory tract
  - Strains affecting synovial membranes
  - Strains affecting oviduct

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LESION CLINICAL SIGN & LESION

- Respitory tract
- Articular lesion with amyloid
- Keen bone bursa inflammation
- Abnormal apex eggs

MG APEX ABNORMAL EGGS

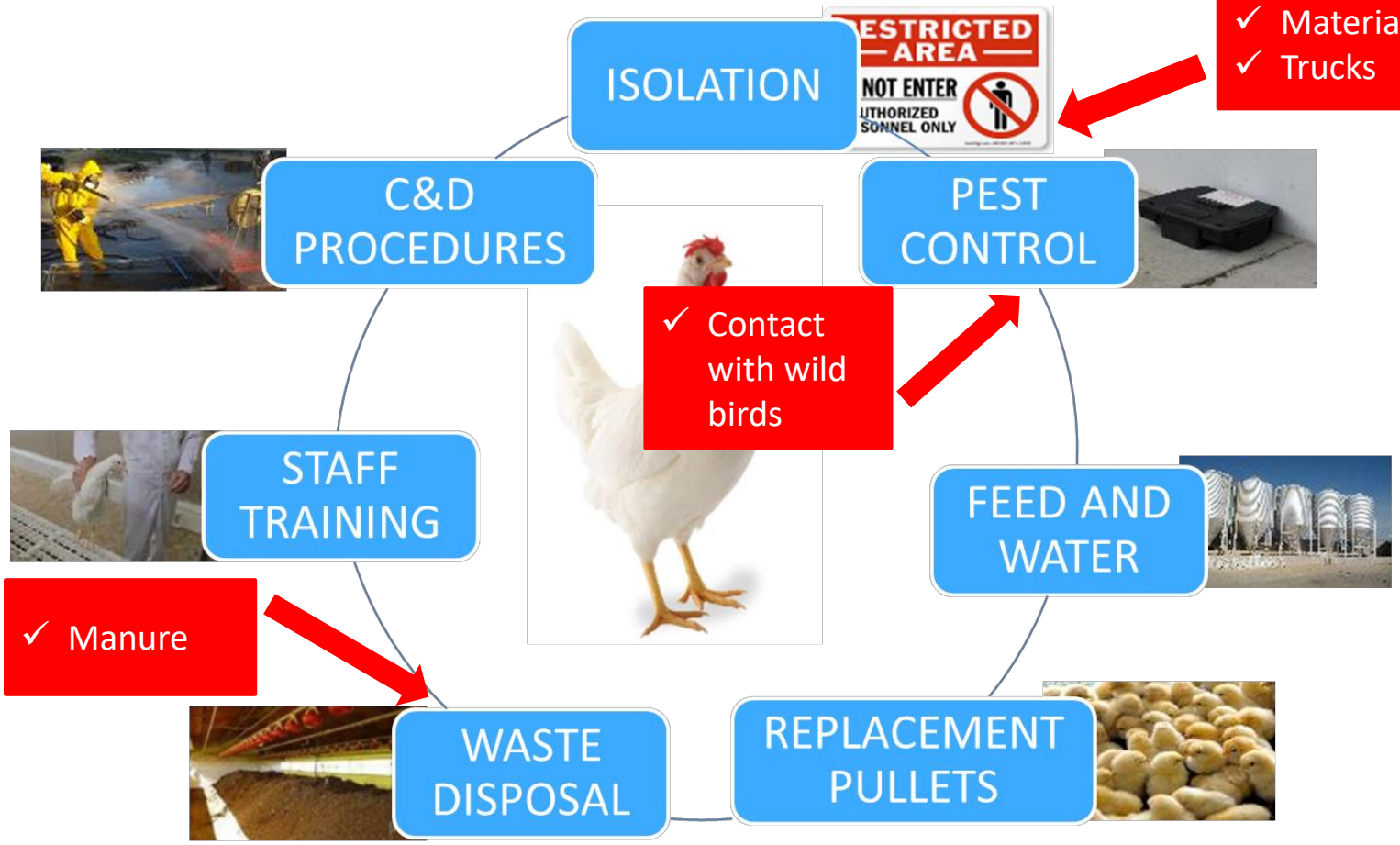
- Up to 10% AA eggs
- Decreaded egg size
- Egg shell thickening

MS CONTROL

- Same as in MG control!!!
- Different vaccines available

Vaccine	Strain	Route of administration	Storage
Vaxsafe MS-HH	MS-H	Eye droplet	Dried ice
Nobilis MS Live	MS1	Spray	2-8 C

BIOSECURITY



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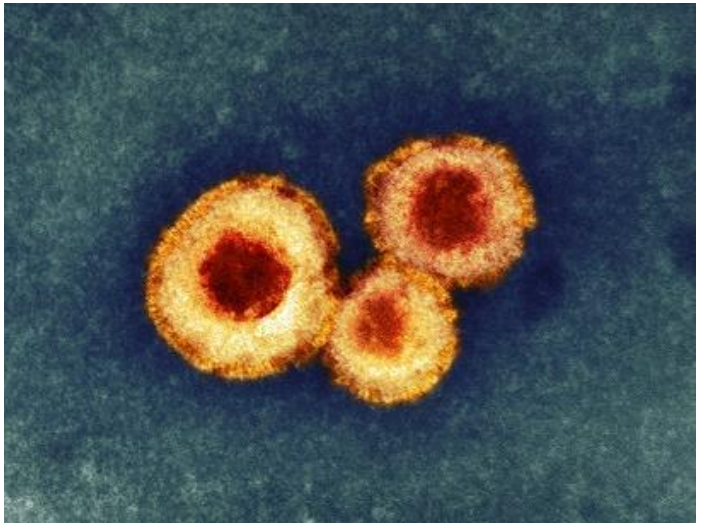
AVIAN PNEUMOVIRUS

AMPV



- Avian metapneumovirus
  - Related to Paramixovirus
  - Two serotypes in Europe (A and B) and one more in NA (Colorado)
- Highly pathogenic in turkeys
- Some strain causing pathology in chickens
- Role in respiratory health

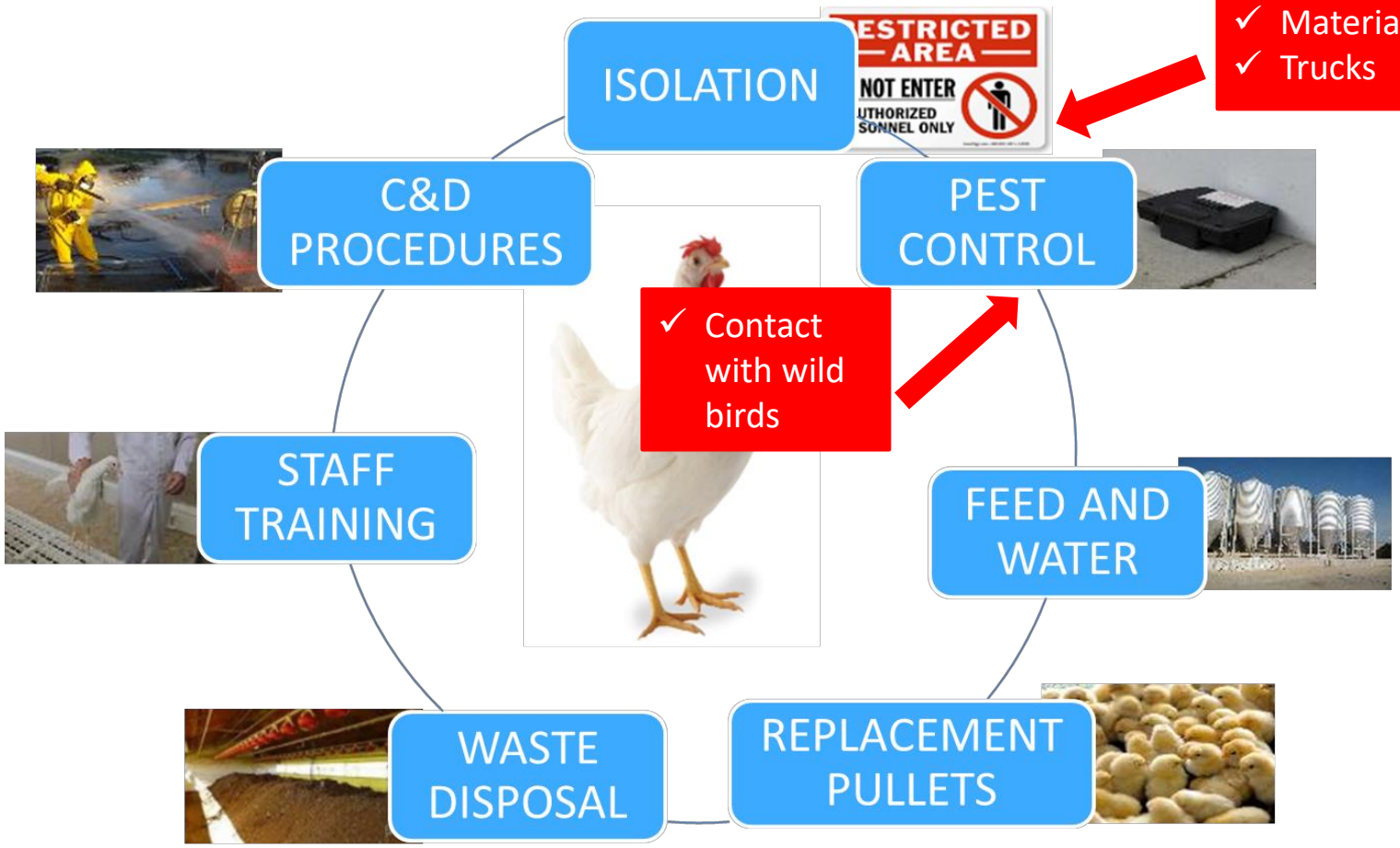
AMPV

- Swollen head syndrome → in turkeys not so clear in hens
- Production drop
- White eggs in brown layer

AMPV

- BIOSECURITY
- VACCINATION
  - Live vaccines (1-3 doses depending on field challenge) + inactivated (1 doses)
  - Vaccine strain from turkey and hens isolated virus
  - Good cross protection between serotypes

BIOSECURITY



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Escherichia Coli

Escherichia coli

- **<u>Etiologic agent:</u>**

  Eimeria Spp.
- Gram – bacteria. High variability in genetic material
- Opportunistic pathogen most of times
- It is shared with other species.

Escherichia Coli

- Peritonitis,
- pericarditis,
- oophoritis,
- salphingitis,
- perihepatitis

An opportunistic bacteria?

- Routinely isolated from gut flora of healthy hens
- Pathogenic and nonpathogenic isolates of E. coli are similar in biochemical characteristics
- A number of potential virulence factors have been identified in APEC strains

Virulence factors

- Certain O serotypes (O1, O2, O78)
- K80 capsular antigens
- Colicin production (esp. ColV)
- Presence of siderophores (aerobactin)
- Fimbria
- Non-fimbrial adhesins
- Motility Outer membrane proteins (traT, iss)
- Enterotoxins (STx,VTx,LT,ST)

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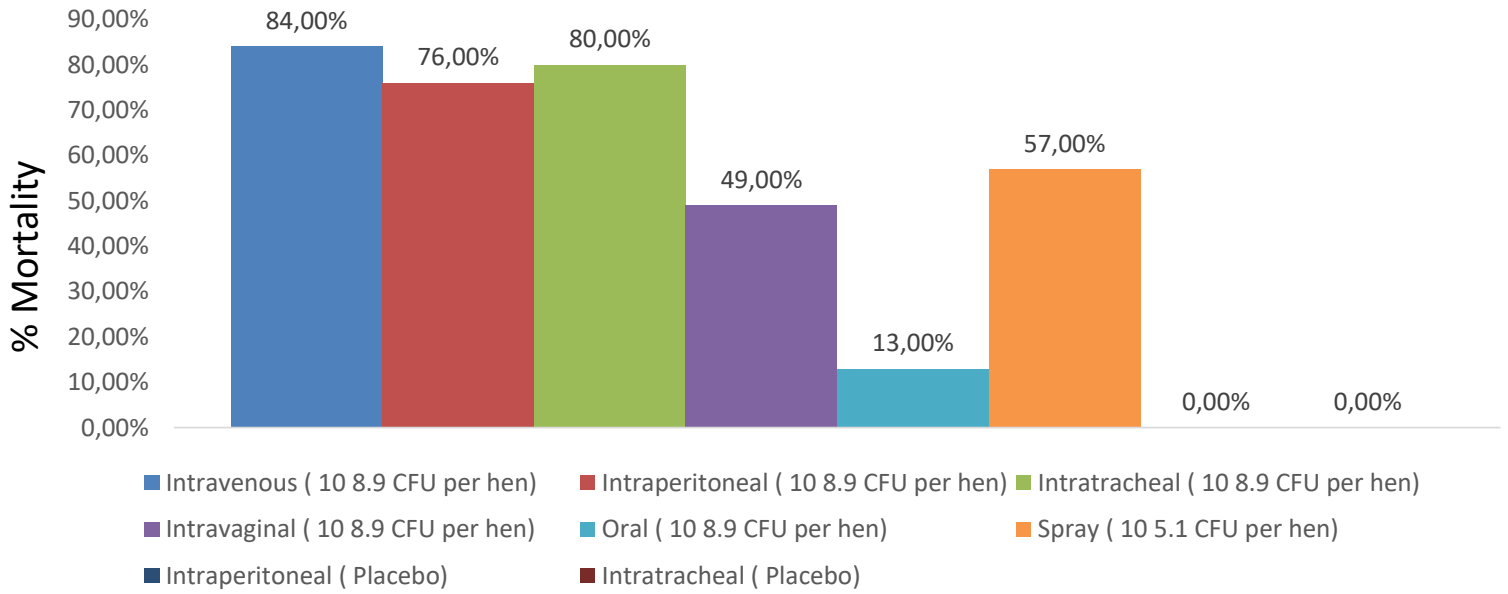
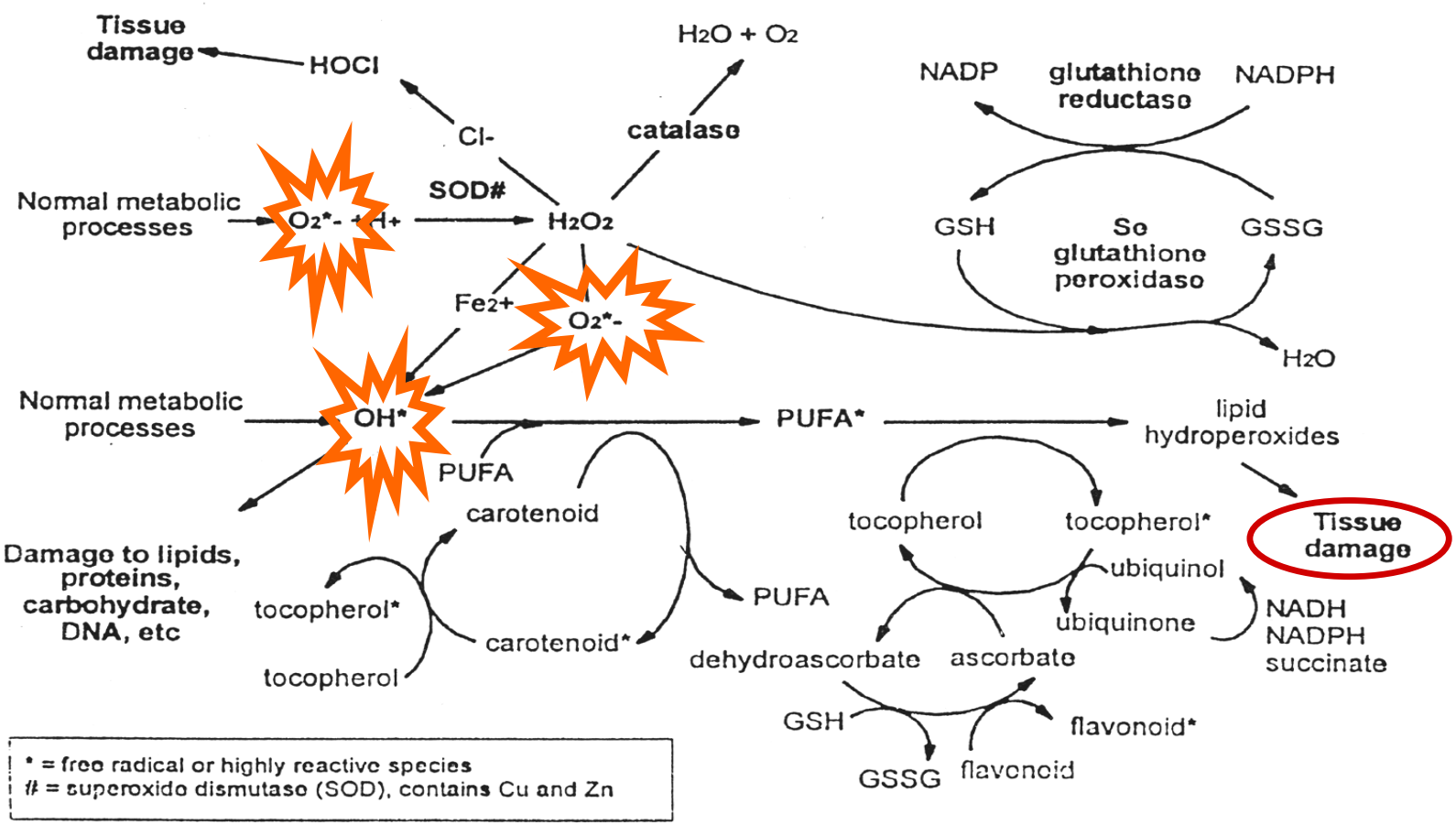
Route of infection

Egg-producing brown layers of various ages challenge by APEC



Landman 2014

Oxidative stress



CONTROL

- Good husbandry
- Good tracheal health
- Vaccination
  - Live vaccines
  - Autogenous inactivated vaccines
- Antibiotics (not in Europe, not in the future)

Epidemiology

Case control study in 40 commercial caged layer flocks

Statistically Significant variables (14/42)

- ✓ Rodents having access to the henhouse
- ✓ Regular treatment against flies
- ✓ Pattern of light increase at the beginning of the batch
- ✓ Pre-lay feed offered
- ✓ Number of other poultry farms within a 1 km radius
- ✓ Percentage in lay at 22 weeks versus the target
- ✓ Number of visitors entering the hen house
- ✓ Frequency of water disinfectant use per year
- ✓ Number of hens in the flock
- ✓ Well depth
- ✓ Distance to the nearest poultry farm
- ✓ Age of beak trimming
- ✓ Volume per hen

Non Statistically Significant variables (28/42)

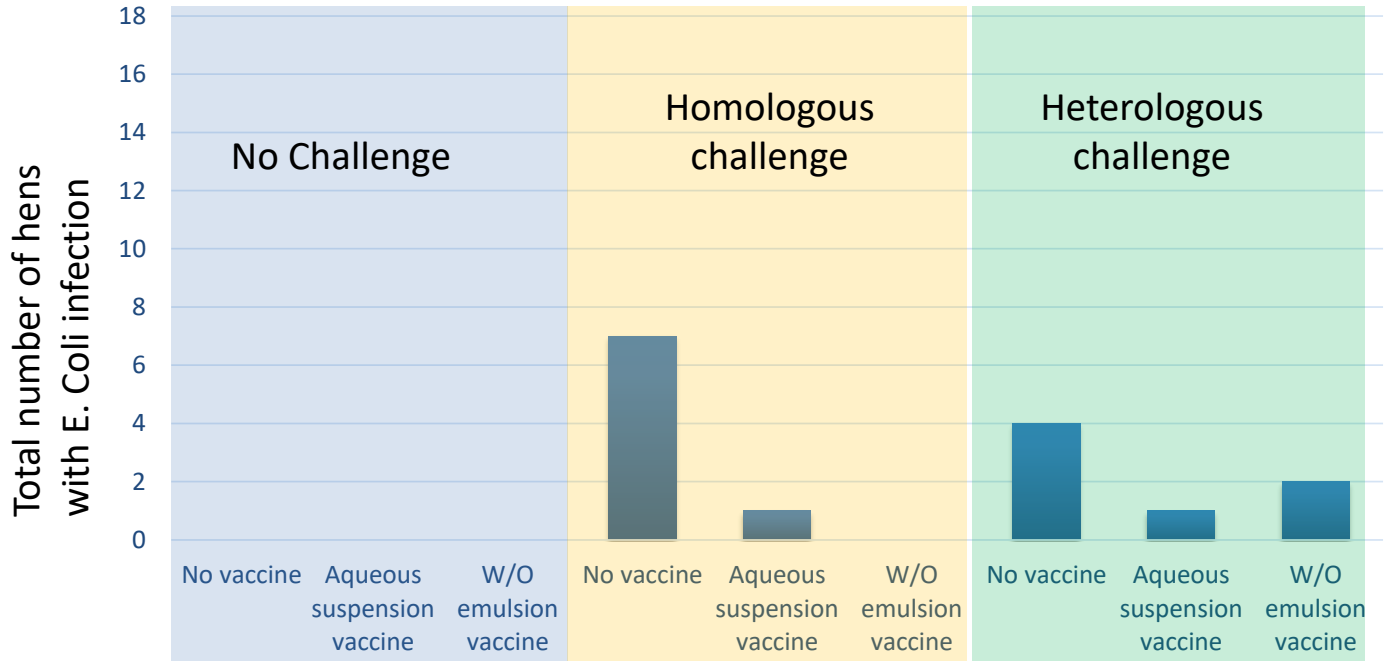
- ✓ Biosecurity score
- ✓ House cleaning method between batches
- ✓ Disinfectant used on house between batches
- ✓ Use of feed supplements
- ✓ Duration house empty between two batches
- ✓ Only poultry kept on the farm
- ✓ Production parameters
- ✓ Extra vaccinations
- ✓ …

Vandekerchove 2004

H&N INTERNATIONAL

Autogenous inactivated vaccines

Brown layers vaccinated with an E. Coli autogeneous vaccine and challenged by homologous and heterologous E. Coli strains



Landman 2017

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The key to your profit!

Vaccine program

Vaccine programs

- Hatchery
- Week 1
- Week 2
- Week 3
- Week 4
- Week 5
- Week 6
- Week 7
- Week 8
- Week 9
- Week 10
- Week 11
- Week 12
- Week13
- Week 14
- Week 15
- Week 16

Coccidia

IB 4/91 + Mass

IB 4/91

IB Mass

MD Rispens

HVT+IBD

AE

Mass

Drinking water

Spray

Individual

Eye drop

Wing web

Live vaccine injection

Killed vaccine injection

Vaccine programs

- Hatchery
- Week 1
- Week 2
- Week 3
- Week 4
- Week 5
- Week 6
- Week 7
- Week 8
- Week 9
- Week 10
- Week 11
- Week 12
- Week13
- Week 14
- Week 15
- Week 16

Coccidia

IB 4/91 + Mass

ND Clone

MD Rispens

S. Enteritidis

HVT+IBD

IB 4/91

IB Mass

ND Clone

S. Enteritidis

POX + AE

ILT

E. Coli

IB Mass

S. Enteritidis

MG 6/85

IB

ND

EDS

E. Coli

Mass

Drinking water

Spray

Individual

Eye drop

Wing web

Live vaccine injection

Killed vaccine injection

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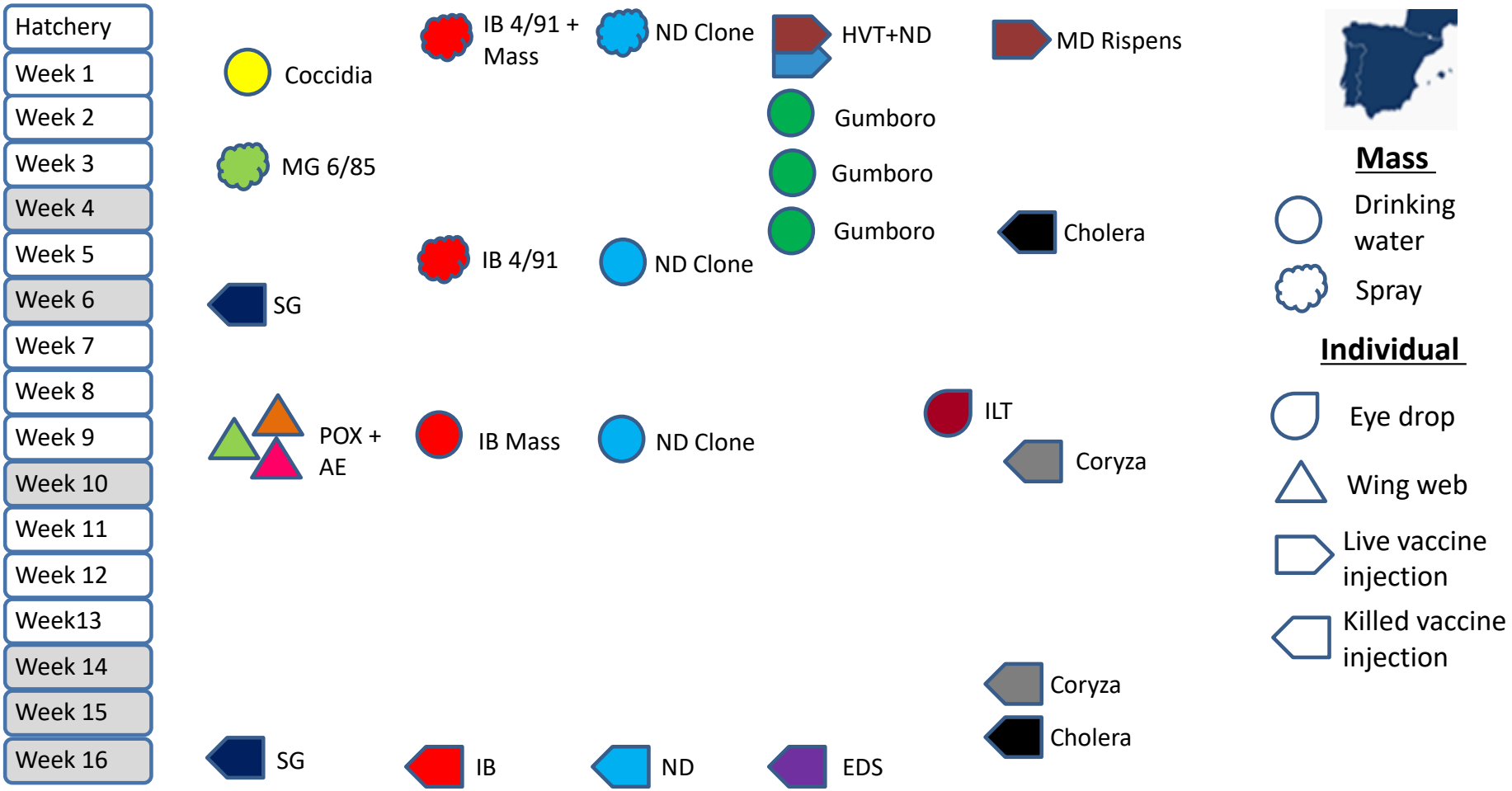
Vaccine programs



THANK YOU FOR YOUR INTEREST

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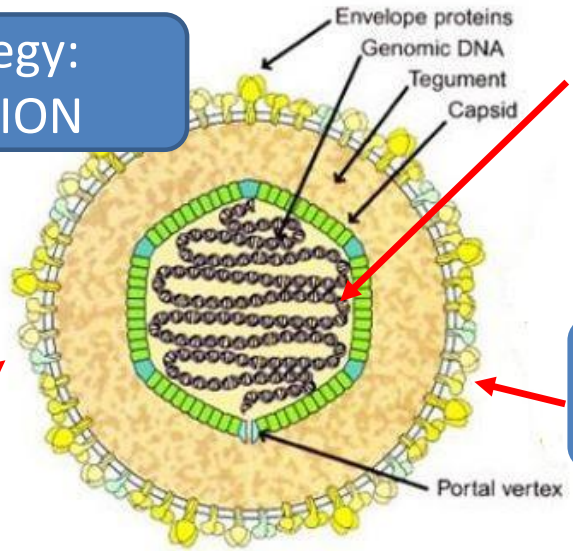
The key to your profit!

INFECTIOUS LARINGO TRACHEITIS

ILT INFECTIOUS AGENT

Gallid herpesvirus 1

Main strategy: COEVOLUTION



Linear 155-kb, double-stranded DNA genome

- Very stable
- Different virulence
- DNA recombination possible

Five major envelope glycoproteins

- Responsible for stimulating humoral and cell-mediated immune responses
- LTV strains appear to be antigenically homogenous

Irregular lipid envelope

- Sensitive to the effects of lipolytic agents, such as chloroform and ether
- Low thermostabilty

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ILT DISEASE

- Highly contagious
- Highly virulent depending on the strain and age
  - Mortality up to 50%
  - Egg drop
- Acute respiratory disease:
  - Nasal discharge
  - moist rales
  - coughing and gasping
  - expectoration of blood-stained mucus
- Virus can remain latent in infected birds for life

Pictures from Dinev

PATHOGENESIS

latently infected carriers

Pictures from Dinev and Betti

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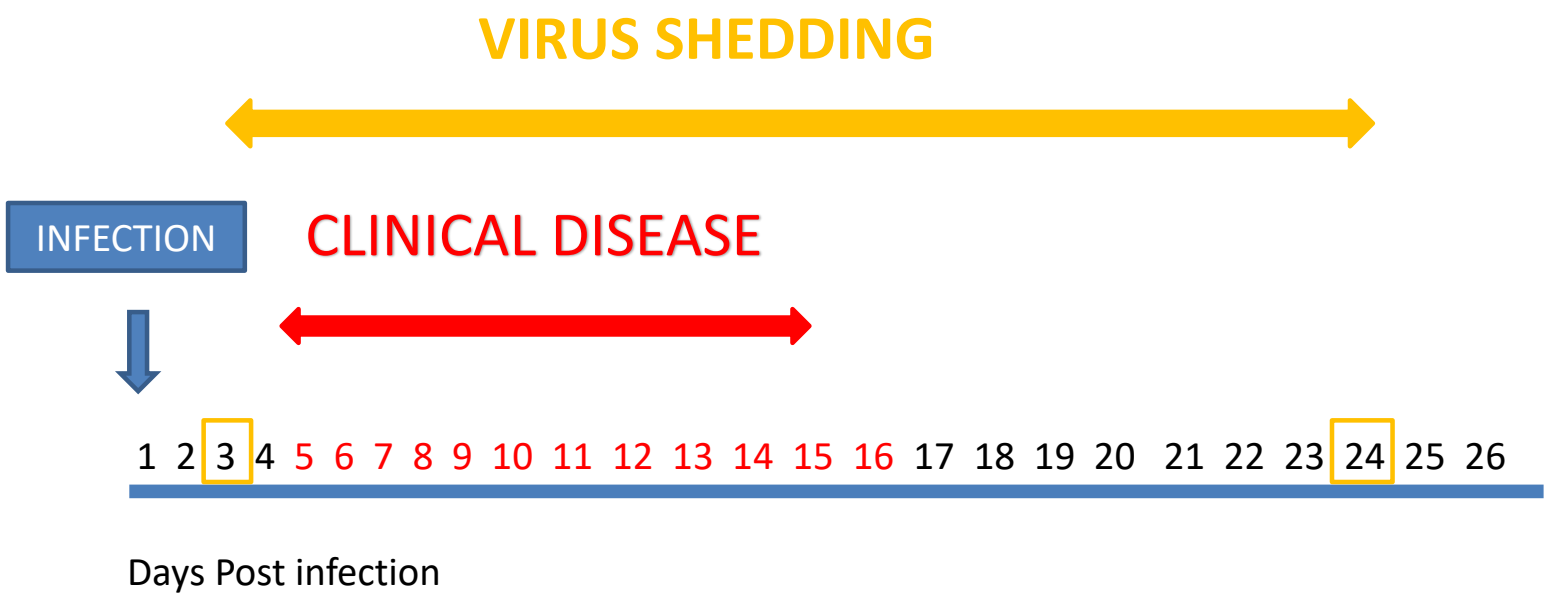
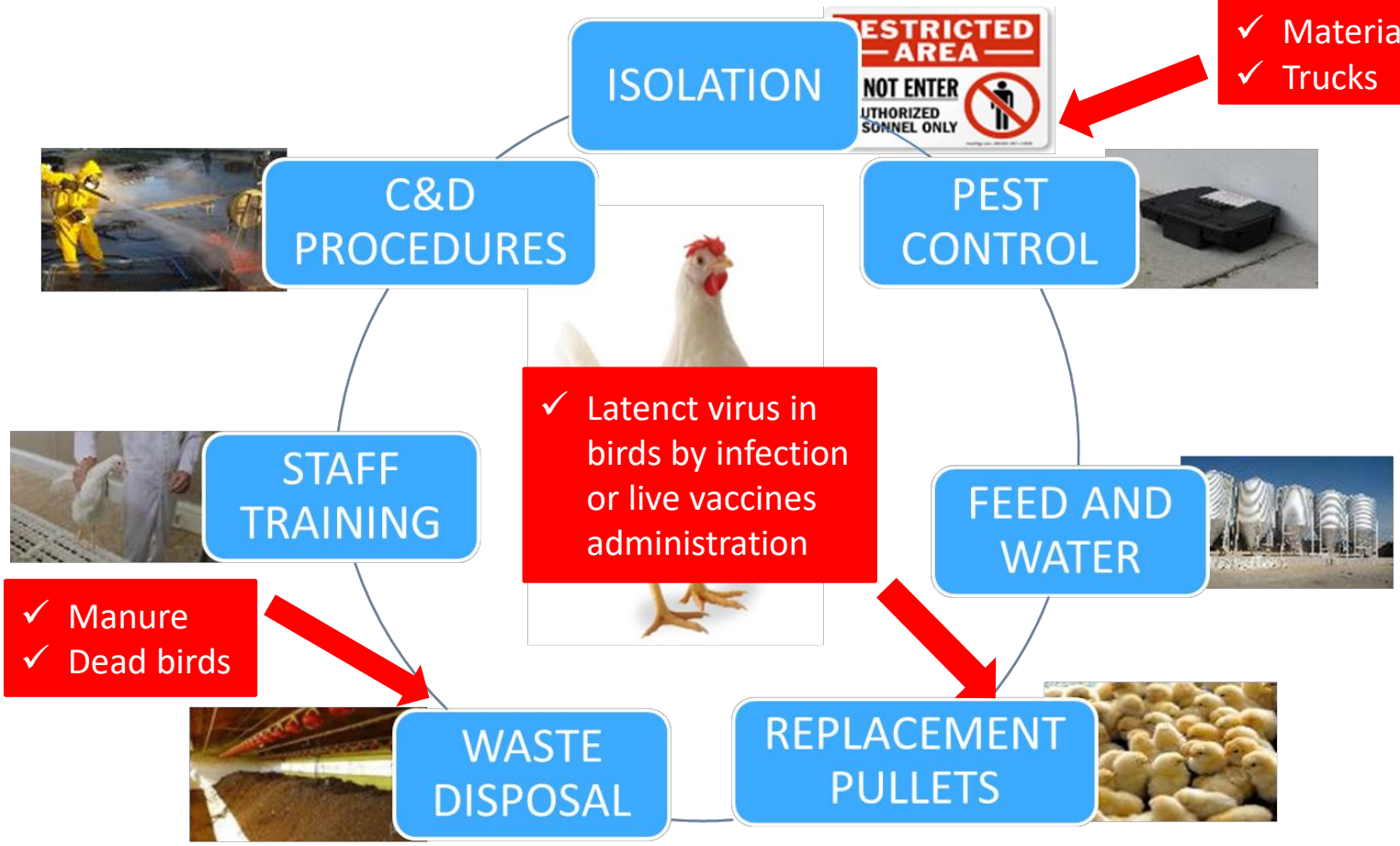
INFECTION CRONOLOGY



ILT CONTROL

1. Education
2. Biosecurity
3. Diagnostic & Coordinated industry response
4. Vaccination:
   - ✓ Live vaccine
   - ✓ Recombinant vaccine

ILT BIOSECURITY



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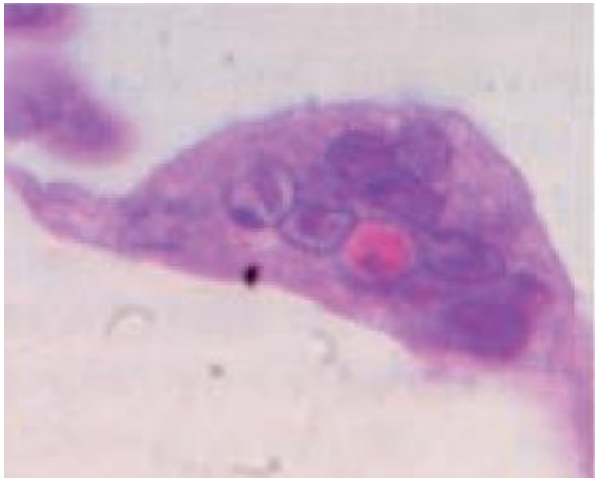
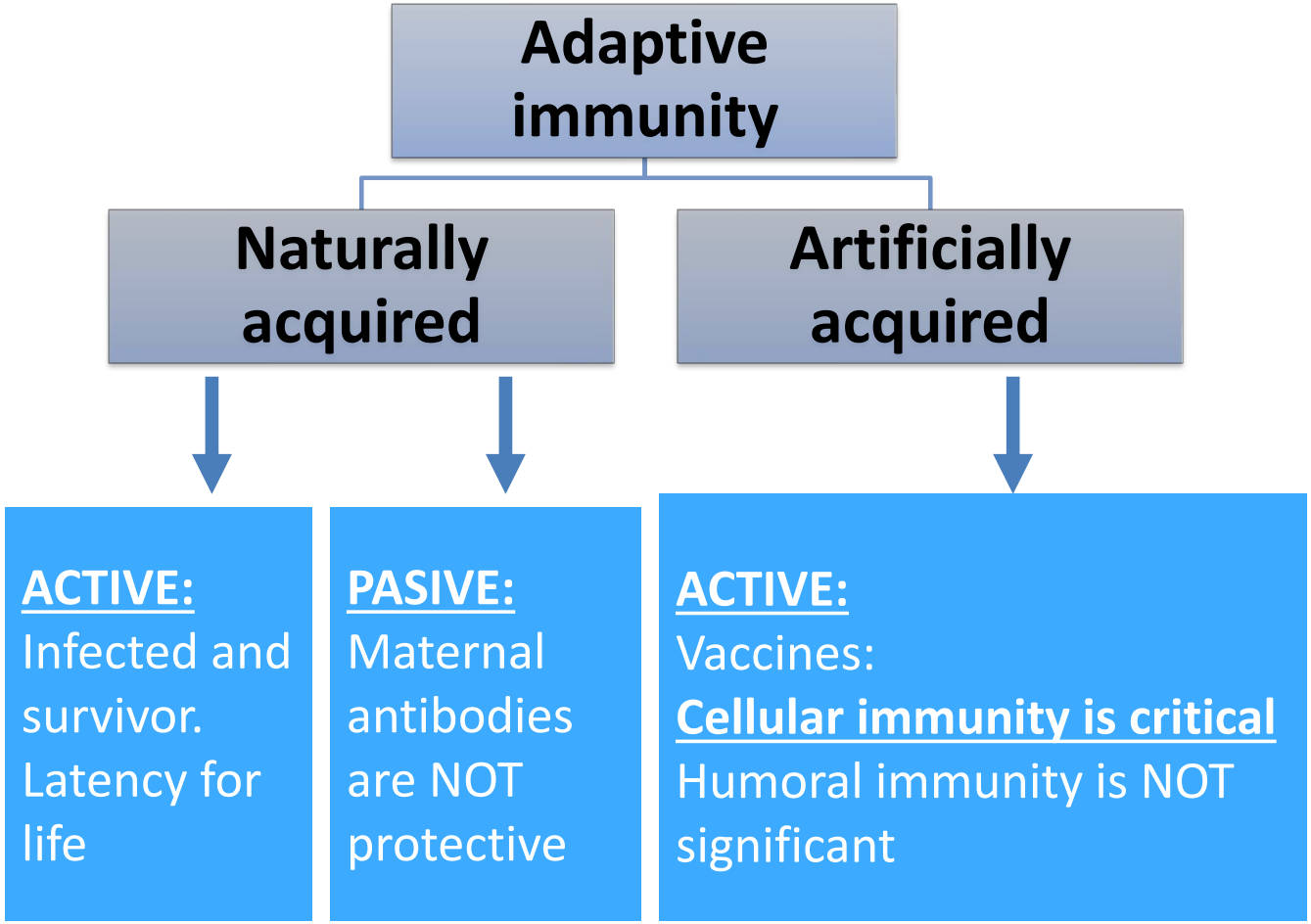
DIAGNOSTIC

- Gross lesion are very revealing but lab confirmation is still needed
- Lab confirmation:
  - Histopathology: Intranuclear inclusion bodies in respiratory epithelial cells
  - PCR
  - Viral isolation: in chicken embryo
  - Virus antigens detection in tracheal tissues or respiratory mucus
  - Serology ???



Pictures Diseases of Poultry

IMMUNITY AGAINST ILT



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ILT VACCINES TYPES

Vaccine type	Protection	Reaction	Shedding	Latency	Administration
CEO (Chicken Embryo Origin live attenuated vaccine)	++++	+++	-	+	Eye drop, spray,water
TCO (Tissue Culture Origin live attenuated vaccine)	+++	++	+	+	Eye drop
HVT-LT (HVT Marek virus + ILT recombinant vaccine)	++	-	++	-	SC Injection, In ovo
POX-LT (Fowl pox virus + ILT recombinant vaccine)	+	-	+++	-	Web wing, In ovo
Inactivated (killed whole virus vaccine)	-	+	-	-	IM injection

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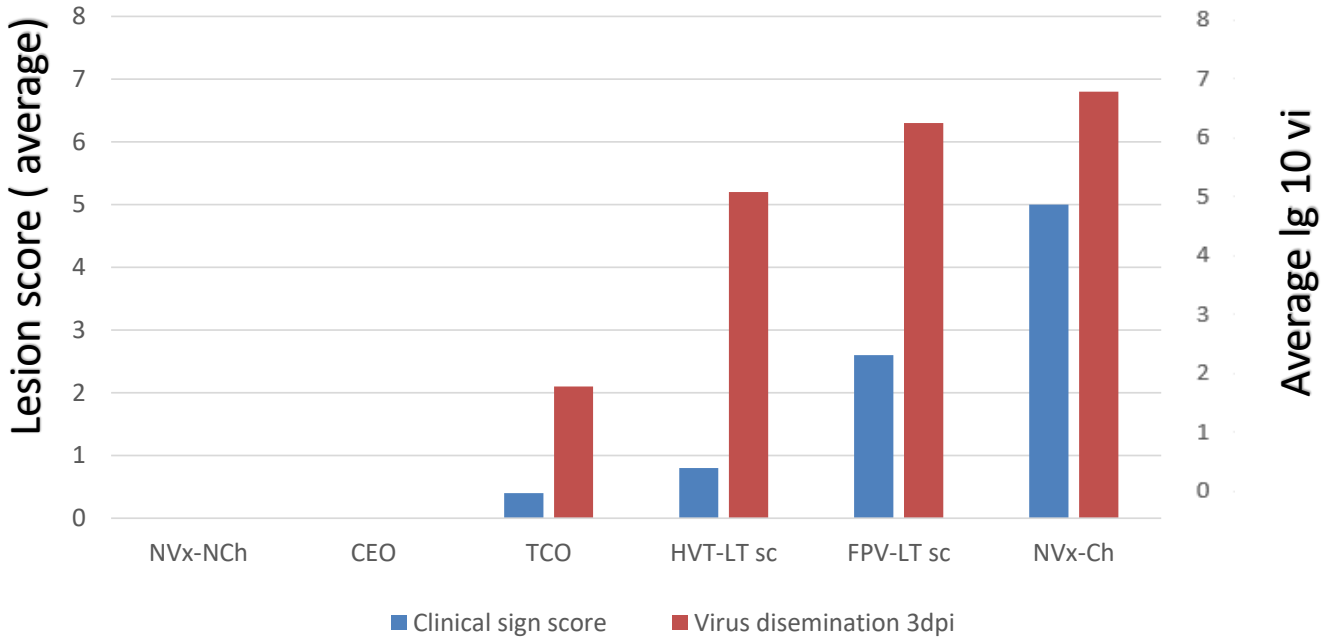
ILT VACCINES

Protection induced by different vaccines types & viral shedding in 35 day old broilers

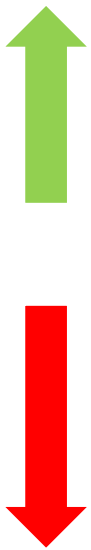


Adapted from A. Vagnozzii

LIVE ATTENUATED VACCINES

Vaccines:

- CEO (Embryo origin)
  - Best protection, no shedding
  - Different strains, different attenuations level in the market
  - Administration by drinking water, spray and eye droplet
- TCO (Tissue origin)
  - Good protection, low shedding
  - Only can be administered by eye droplet



1. Good protection
2. No shedding

1. Delay in growth
2. Latency in vaccinated birds
3. Possible reversion to virulence

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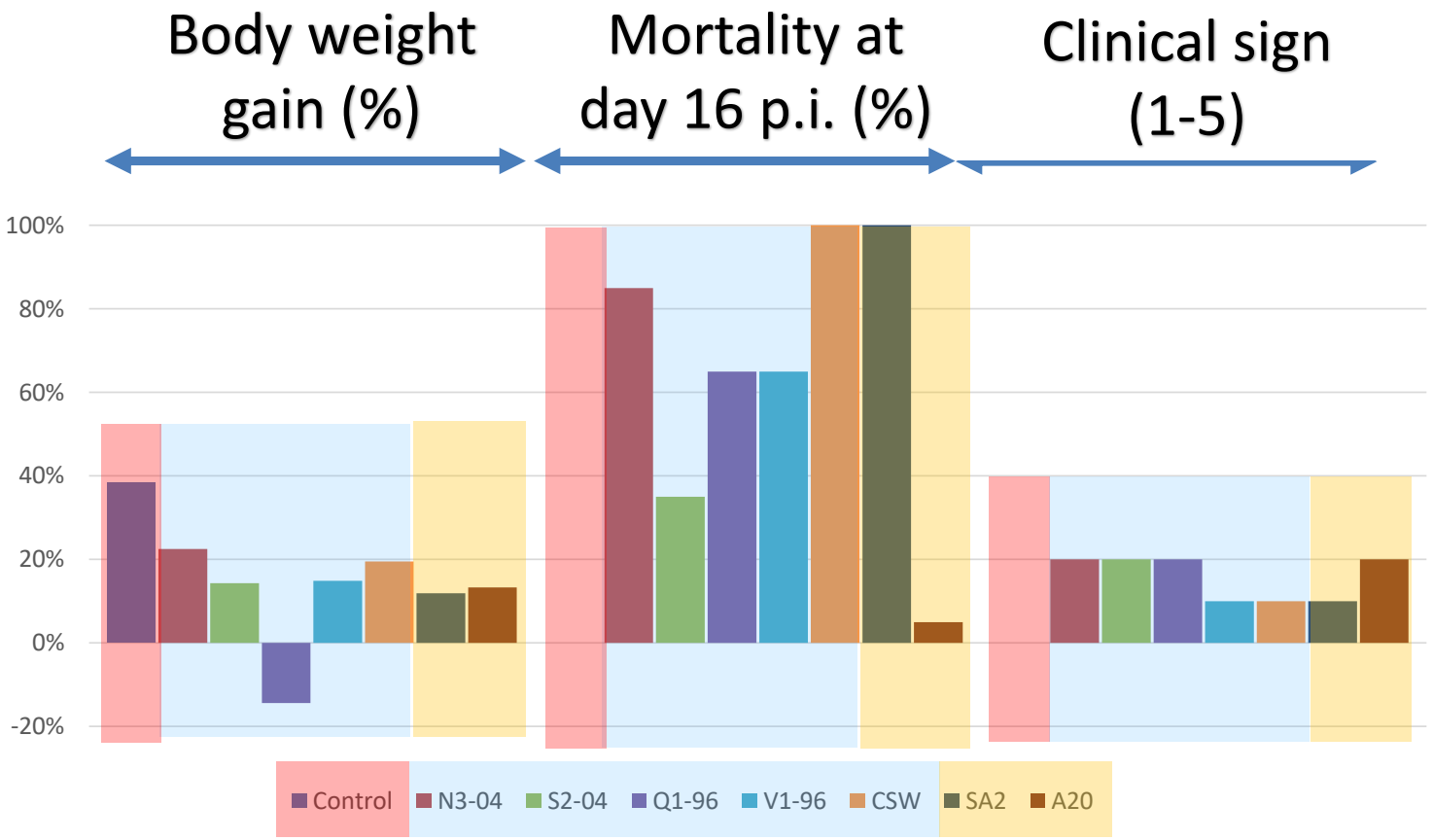
LIVE VACCINES CEO STRAINS



Adapted from
N. Kirkpatrick

Different field strain
from Australia

Vaccine strain

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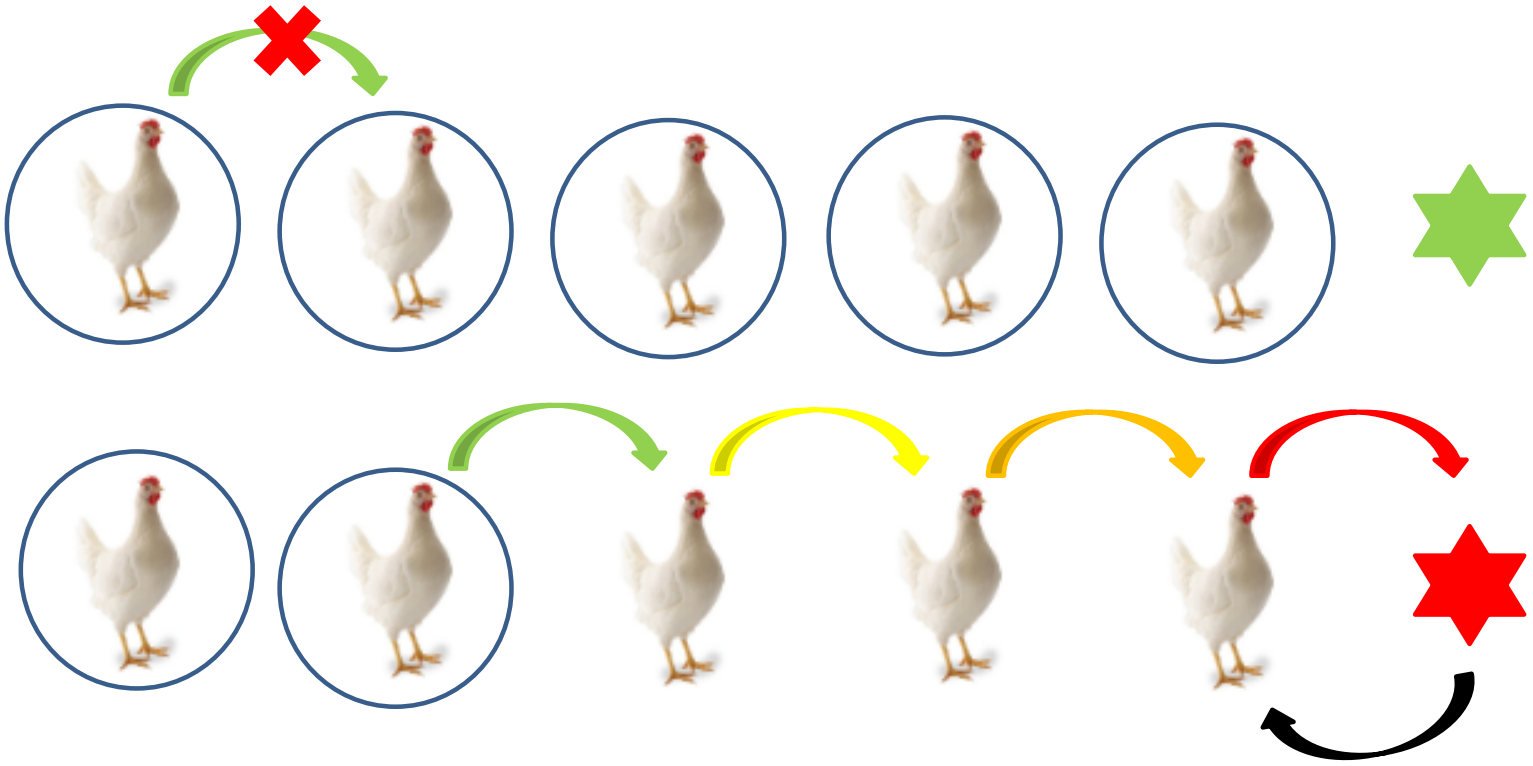
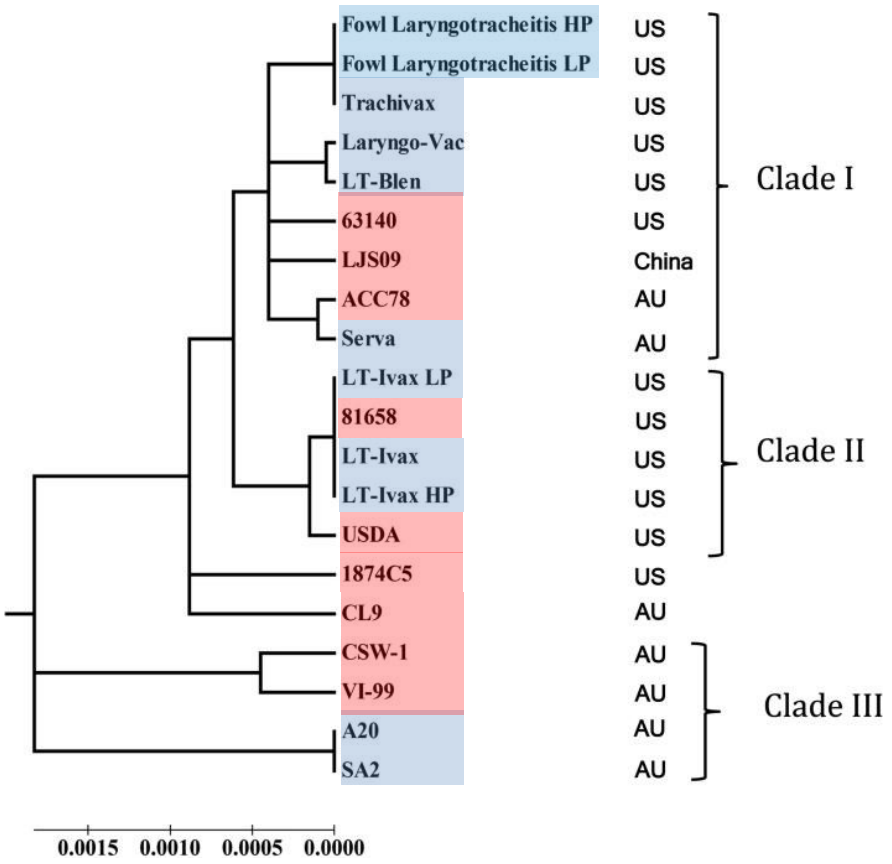
REVERSION TO VIRULENCE



REVERSION TO VIRULENCE



Vaccine strain

Field strain

Circulating ILT strains have shifted from wild type to virulent vaccine related strains

Source: K. Menedez

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LIVE VACCINES ADMINISTRATION

- Vaccination technique is CRITICAL
  - Immunity is dose dependent
  - Thermolabile vaccine → Cold chain !!!
  - Do not vaccinate earlier than 14 days
  - NDV and IBV vaccines interfere with live ILT vaccines
  - Avoid direct or indirect contact between vaccinated and non-vaccinated flocks
  - <u>Ensure high coverage</u>

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LIVE VACCINES ADMINISTRATION

SPRAY	DRINKING WATER	EYE DROPLET
Rapid, mass Low coverage High risk of reaction	Rapid, mass Medium coverage Higher vaccine concentration needed	Slow, individual Total coverage Crew training is critical

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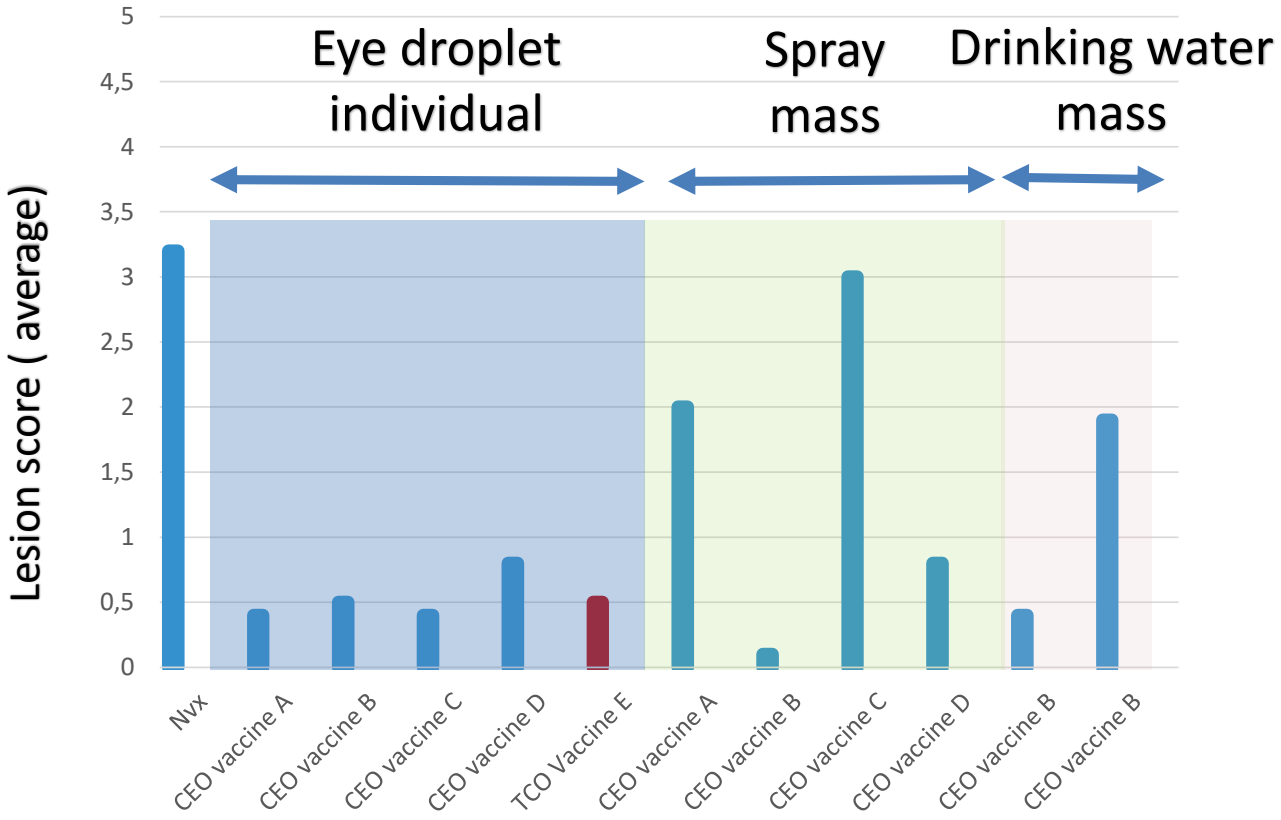
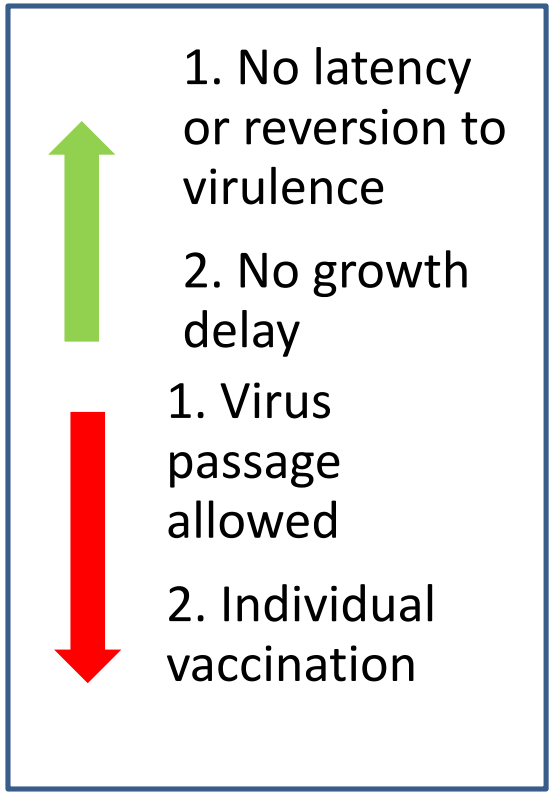
LIVE VACCINES ADMINISTRATION



Source: R. Fulton

RECOMBINANT VACCINES

- HVT-ILT (Marek virus)
  - Good & long lasting protection
  - Dose dependent protection: administration is critical
  - Interfere with other HVT vaccines
  - Administration in ovo or DOC by injection
- POX-ILT (POX virus)
  - Medium protection, high shedding
  - Administration in ovo or 8 week old chicks by wing web



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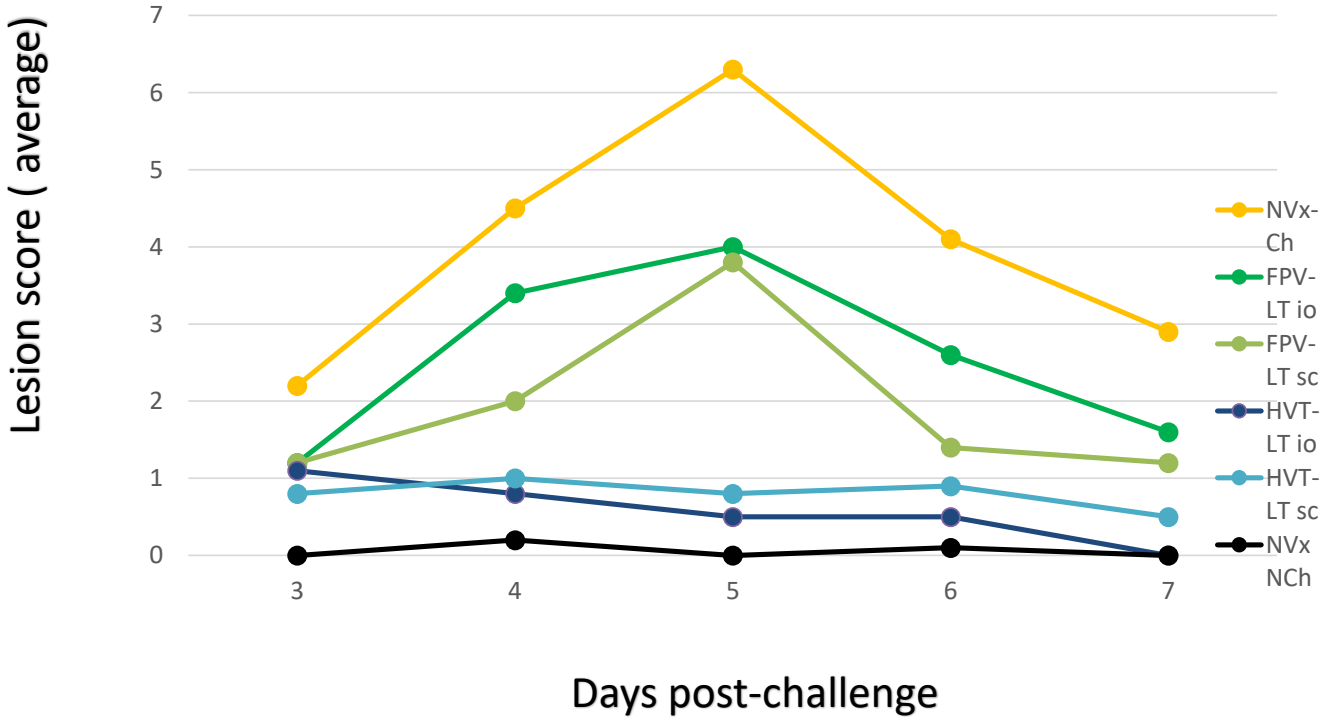
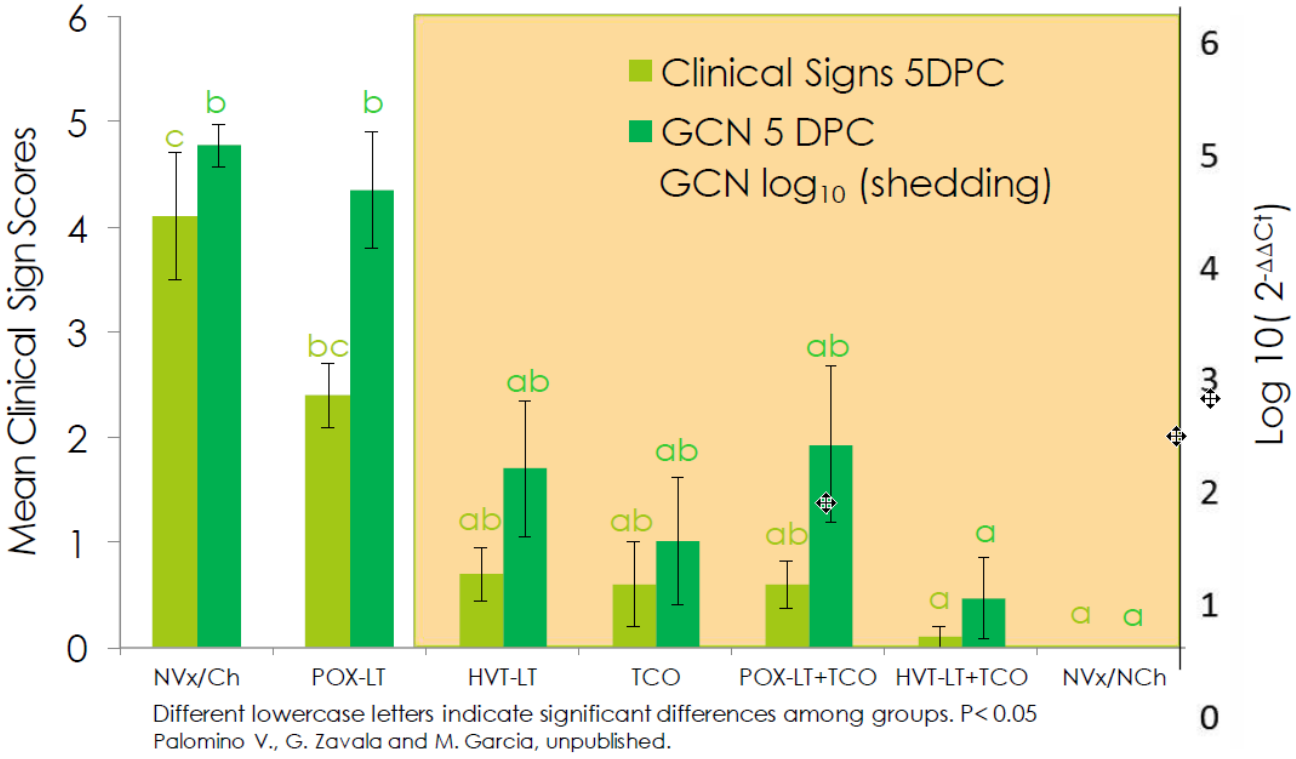
RECOMBINANT VACCINES

Protection induced by different recombinant vaccines in 35 day old broilers



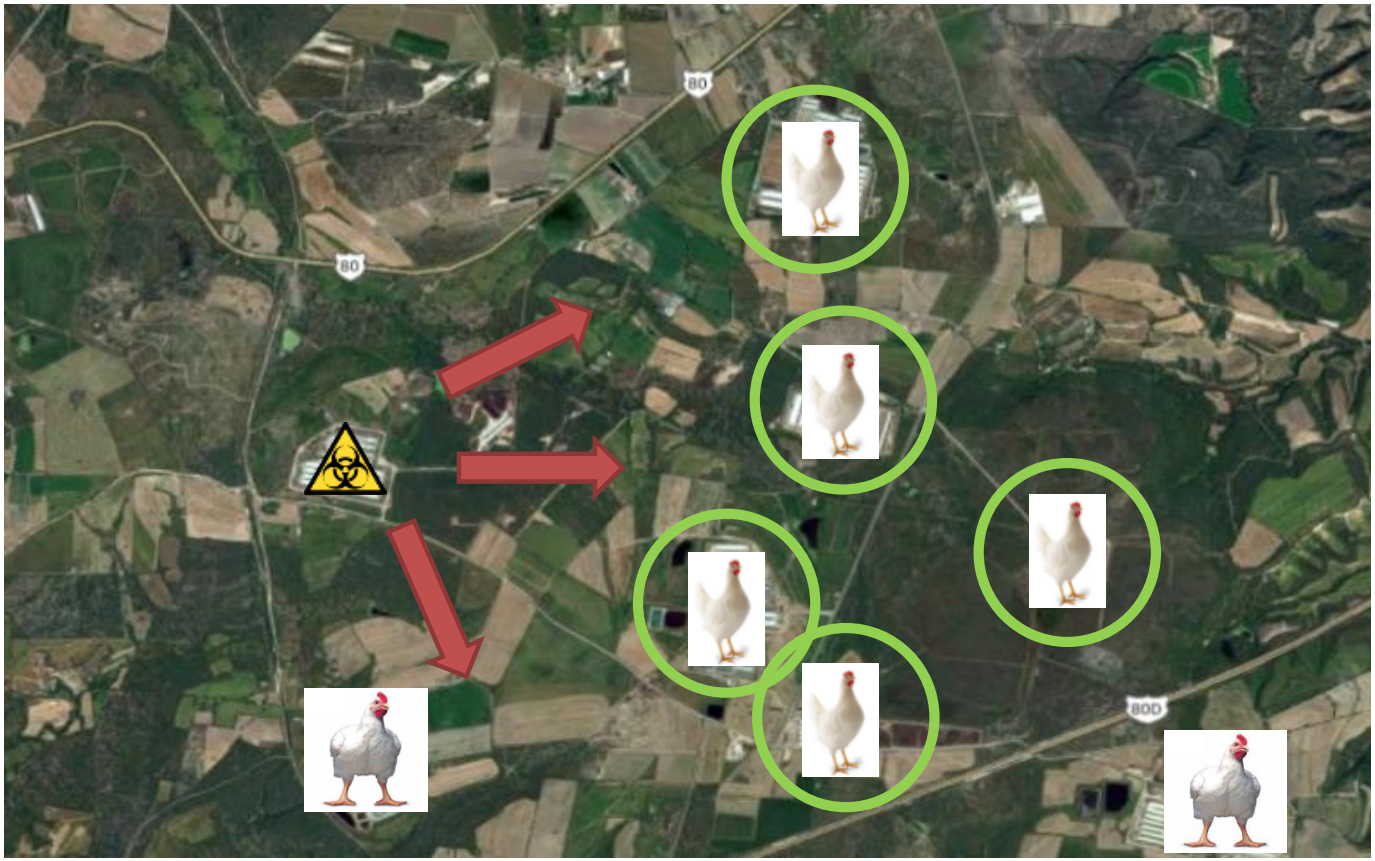
Adapted from A. Vagnozzii

RECOMBINANT VACCINES



Different lowercase letters indicate significant differences among groups. P< 0.05
Palomino V., G. Zavala and M. Garcia, unpublished.

VACCINNE PROGRAMS



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The key to your profit!

Coccidiosis

Coccidiosis

- **<u>Etiologic agent:</u>**

  Eimeria Spp.
- It is a protozoa that needs to cycle in the environment and in the poultry gut
- Different species produces different lesion in the gut
- It is present worldwide

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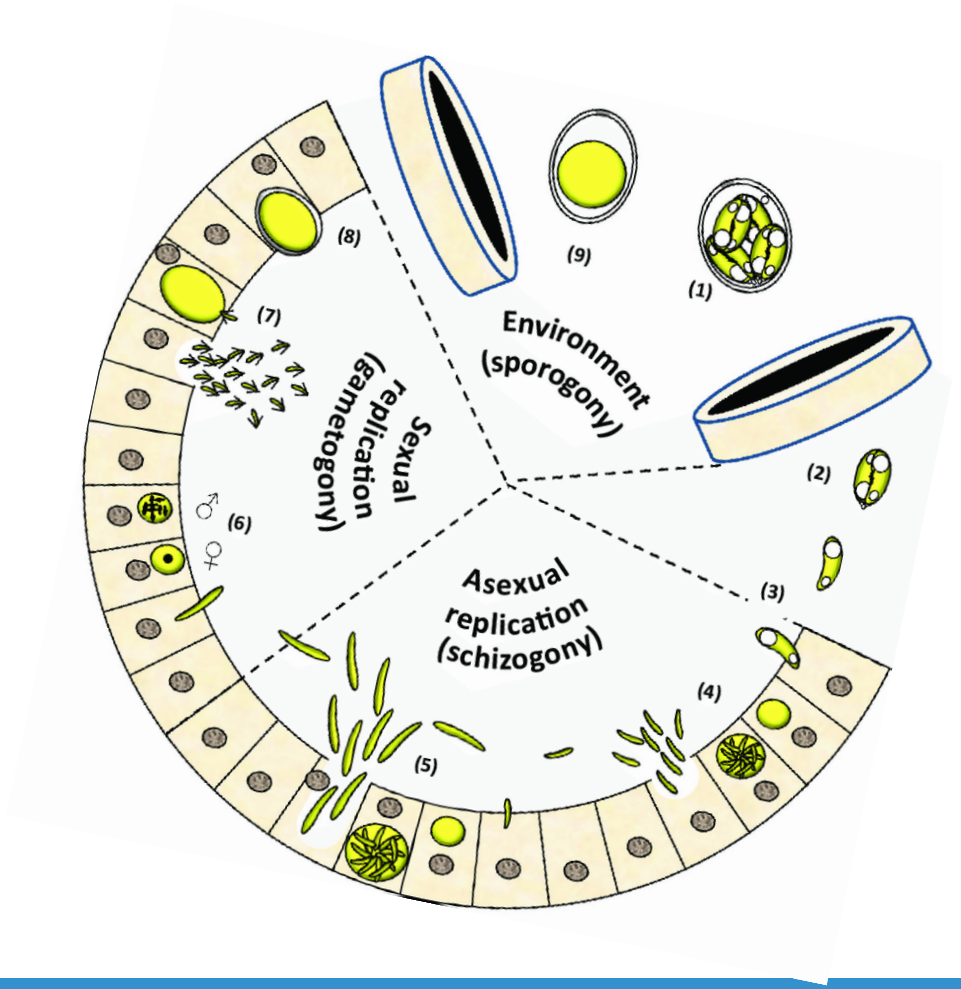
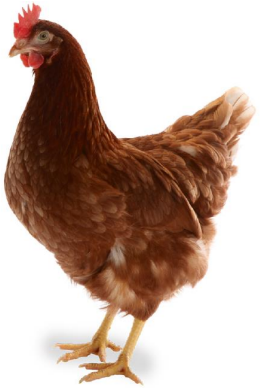
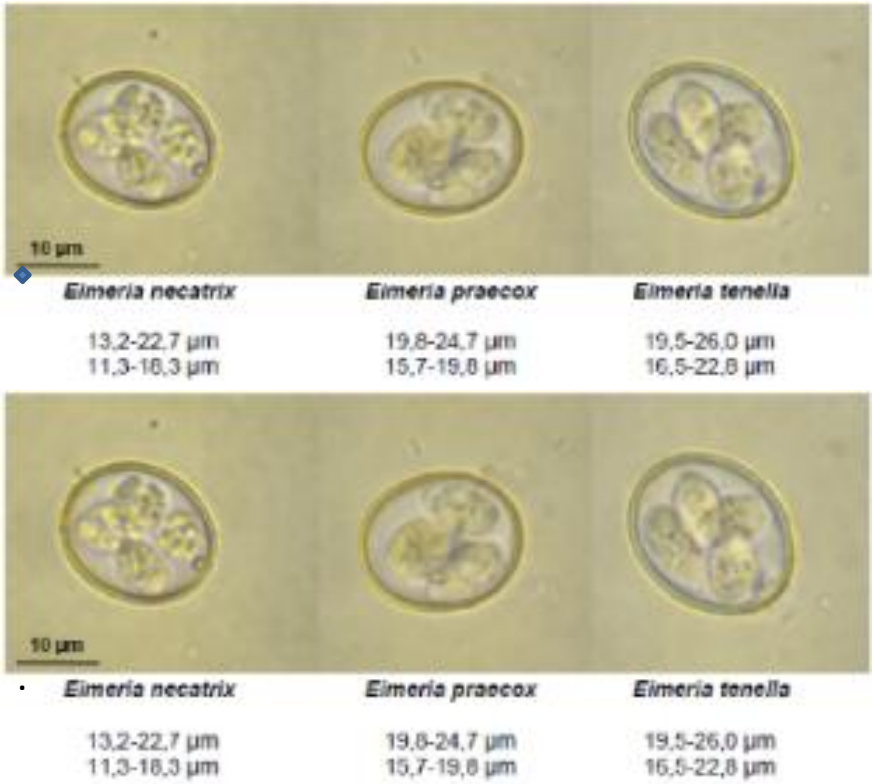
EIMERIA CYCLE





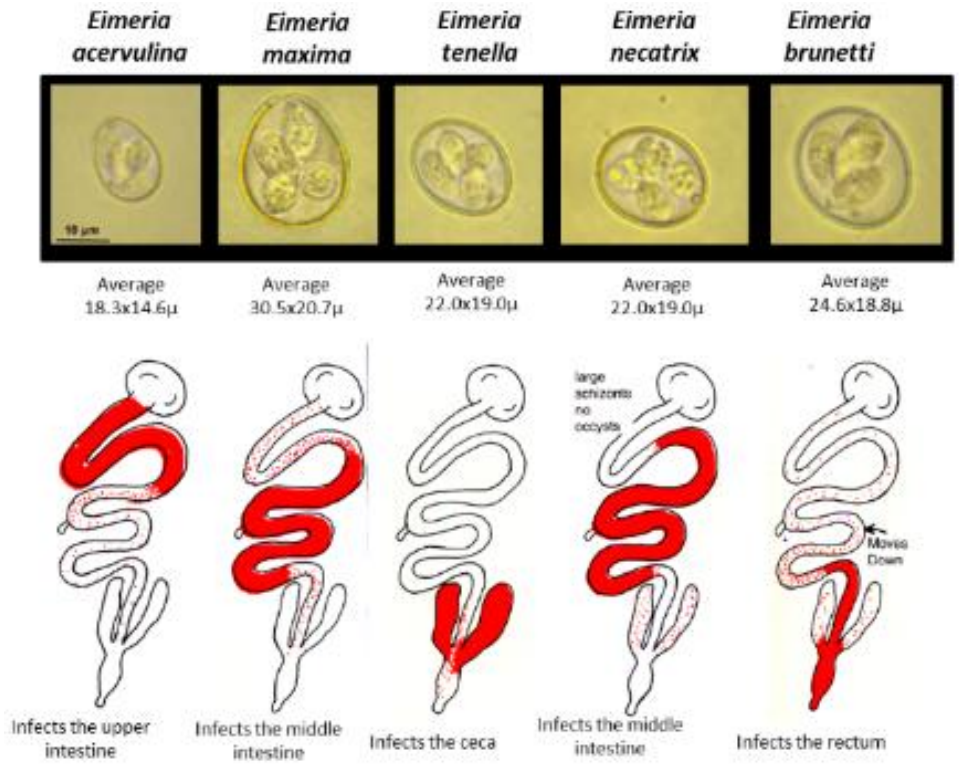
Only one host for specie

POULTRY COCCIDIA



- Infectious form is the oocyst
  - Very resistant in the environment
  - Heavy and big
- Oocyst need to sporulate to become infective
  - Humid and warm ambiance
- It is present worldwide

Eimeria species



- Different species differs in :
  - Oocyste size and morphology
  - Infected part of the gut
  - Type of lesion
  - Prepatent period
  - Sporulation time
- There is no cross protection between species

Lesion Score

Lesion Score

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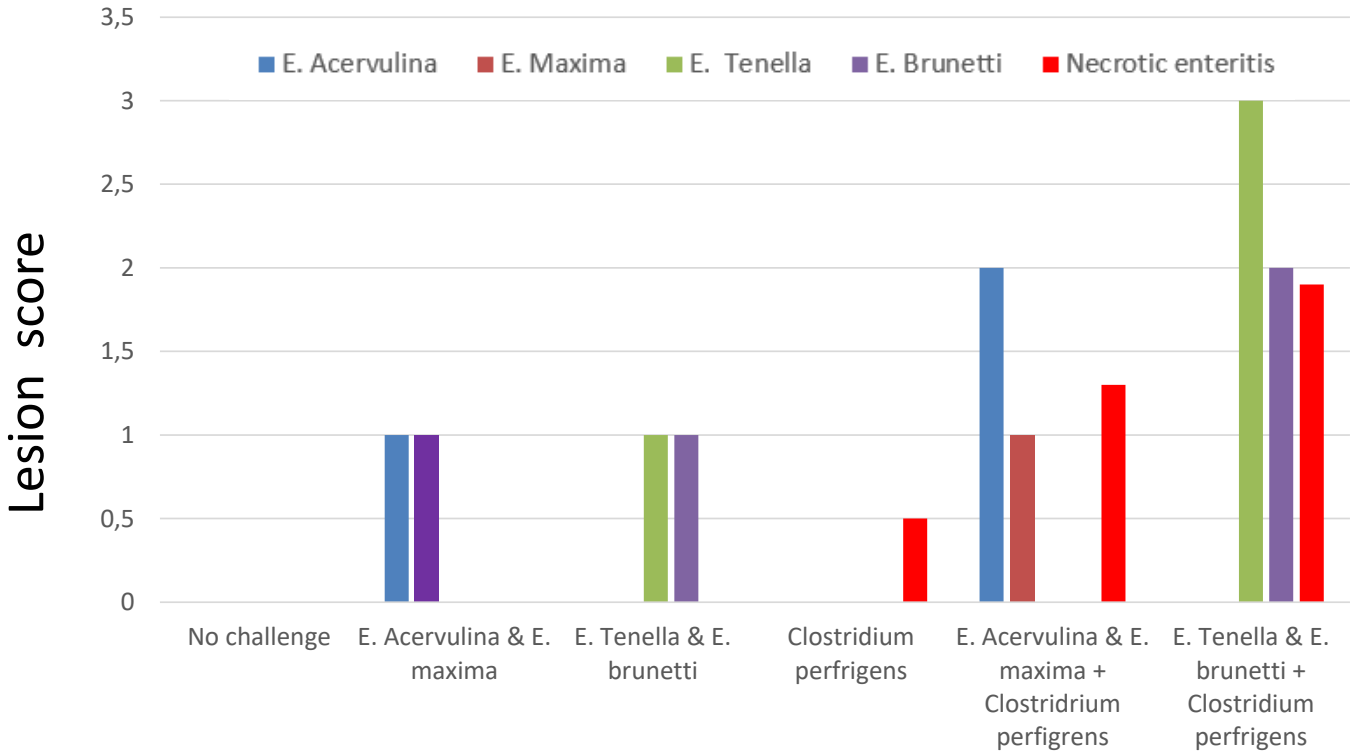
Lesion Score

Lesion Score

Lesion Score

Gut health & Coccidia

60 days old broilers



Alnassan 2014

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CONTROL

- Short life birds
  - Anticocci programs
  - Vaccines

- **Long life birds**
  - **Essential oils**
  - **Vaccines + anticocci programs**
  - **Vaccines**

No delayed growth
No Cocci resistance

Long lasting immunity against the different eimeria species

Challenge required !!!

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Vaccines

Different vaccines types

Type of birds	Type of birds
Short life birds • Eimeria acervulina, Eimeria maxima, Eimeria Tenella, Eimeria Mitis, …	**Live Attenuated vaccines** • Embryonated egg passages (E. Tenella) • Precocious strains
Long life birds • Eimeria acervuline, Eimeria maxima, Eimeria Tenella, Eimeria Mitis, Eimeria Brunetti, Eimeria Praecox, Eimeria Necratix	**Live Non-attenuated vaccines**

Never mix different commercial vaccines

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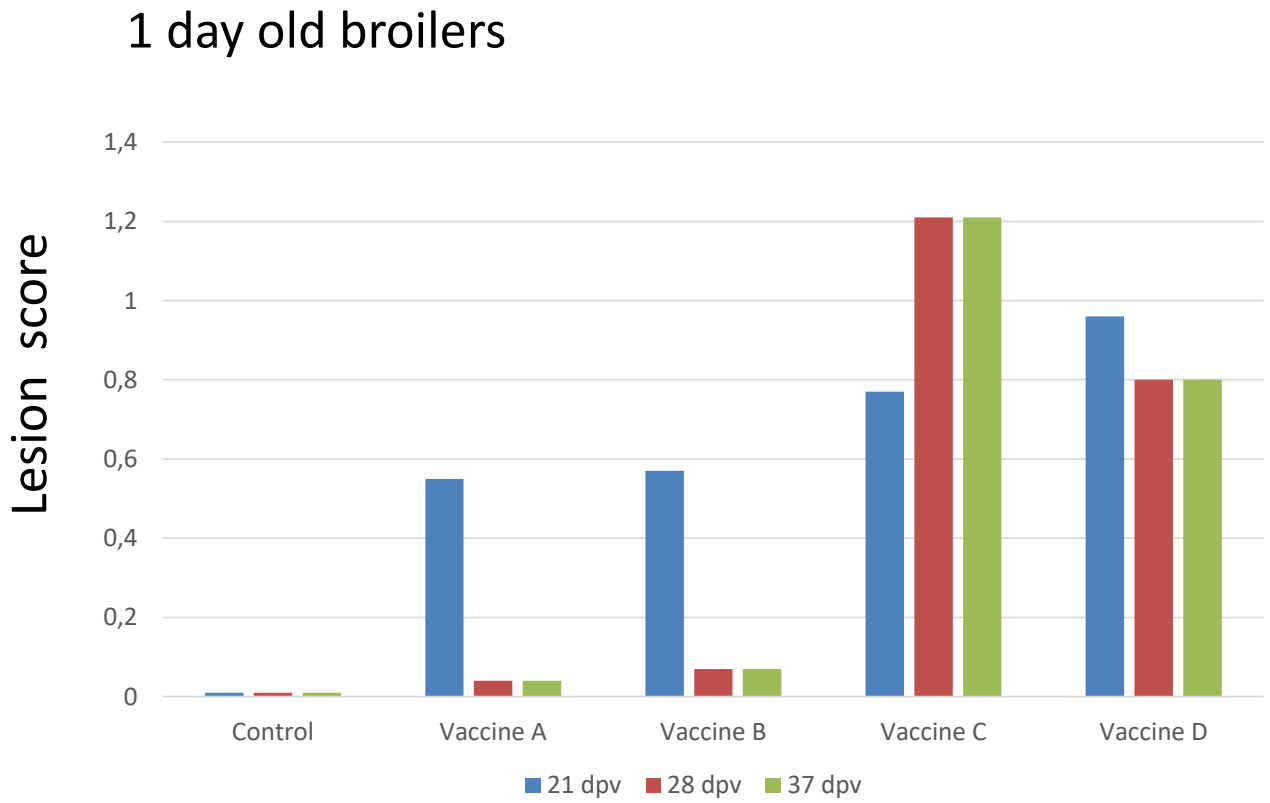
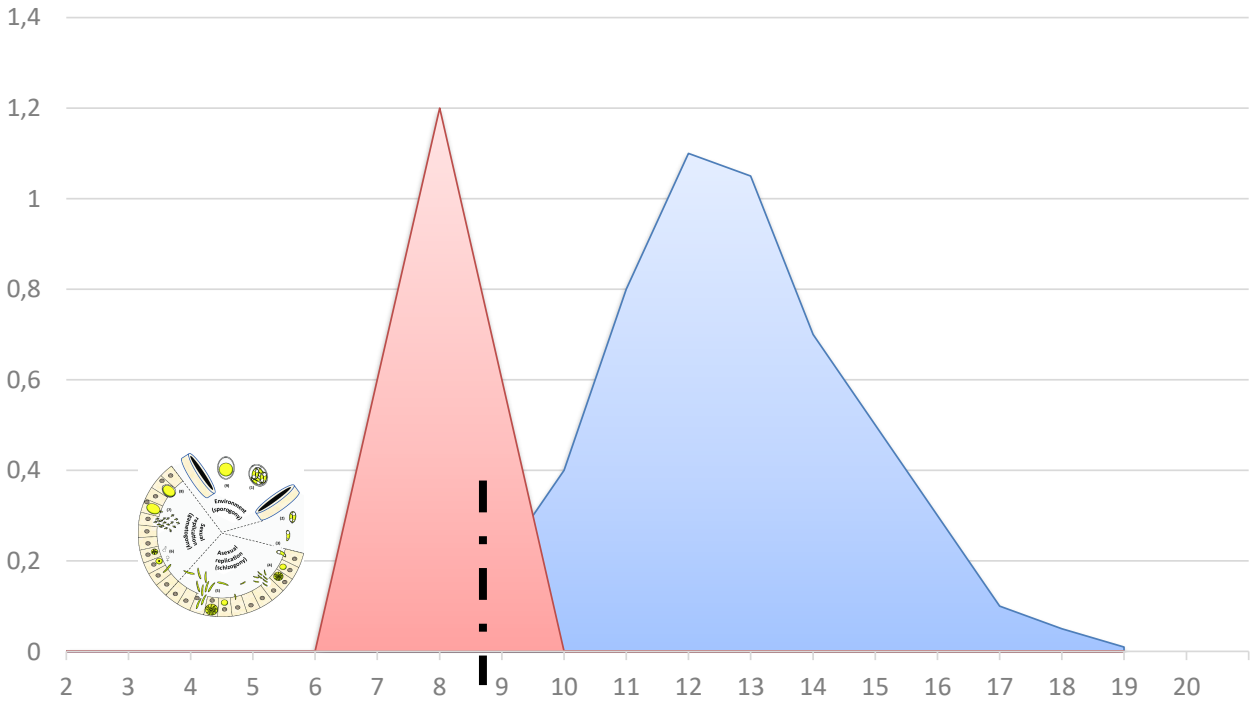
Coccidia vaccines



Adapted form M. Dardi

Attenuation by precocity



Vaccine adminsitration

Spray in farm
Spray in hatchery
~~Spray in feed~~
~~Drinking water (Nipples)~~

RECONSTI TUTION → ADMINIS TRATION → INGESTION → RECICLATION

2. Oocyst resuspension failed

4. Droplet size too small to allow chicks to ingest it

5. No vaccine tank agitation

7. Chicks can not ingest vaccine droplets

8. No vaccine recirculation possibility in farm

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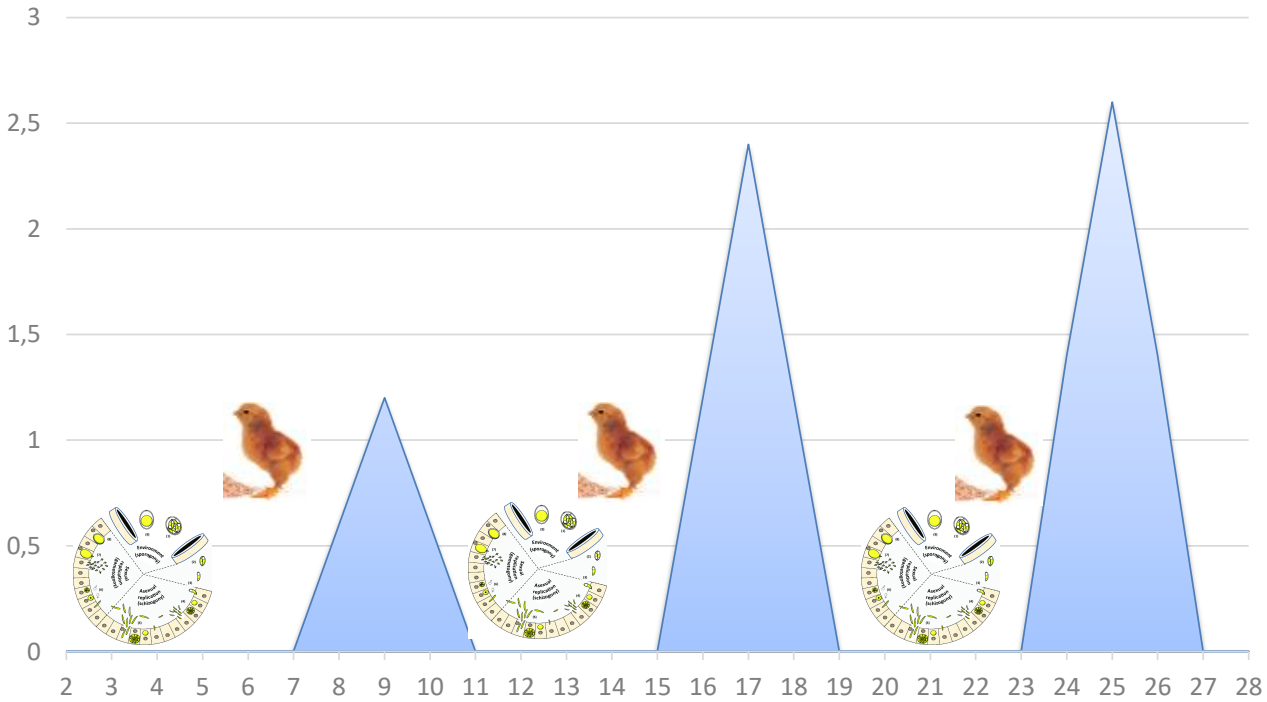
Vaccine recirculation



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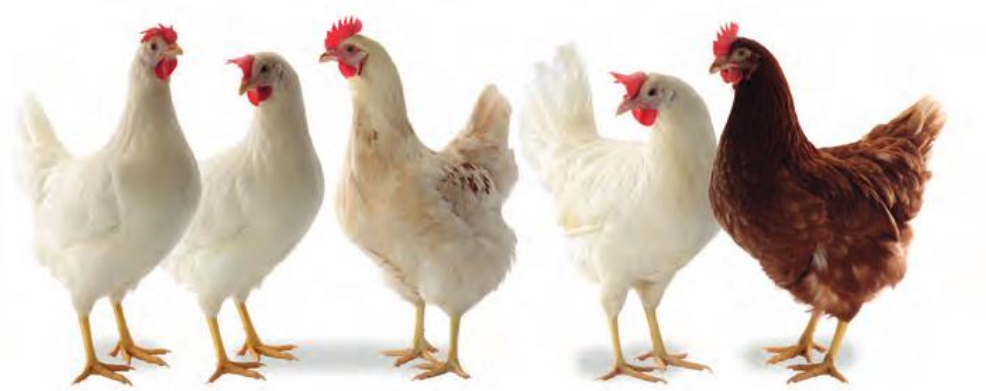
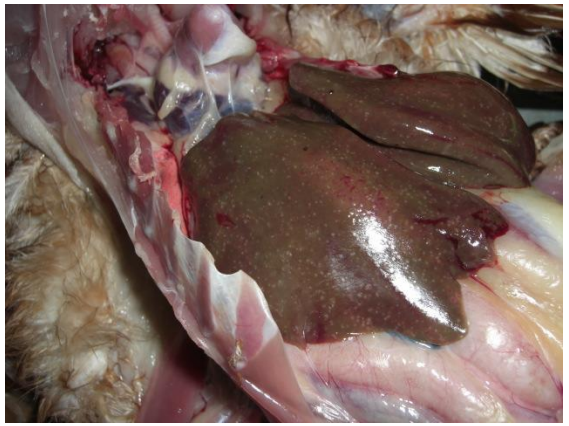
The key to your profit!



Spotty liver

Spotty liver

- **<u>Etiologic agent:</u>** Campylobacter hepaticus
- Increased mortality of laying hens that are in good condition, often decreased production
- Multiple small foci of necrosis and inflammation
- Mostly in free range hens



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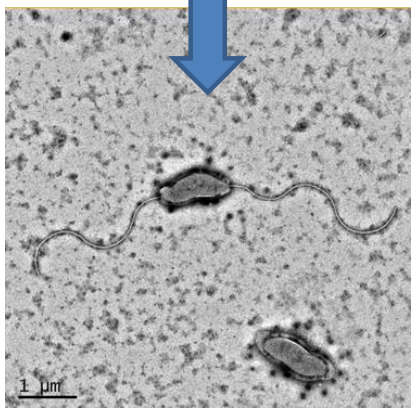
A new disease ?



- 1950 USA. Similar disease in layer
- 1980 Australia. Similar disease reported
- 2000 Australia. Unknown etiology disease outbreaks
  - Vibrionic hepatitis ?
  - Helicobacter pullorum ?
- 2017 Etiologic agent: Campilobater hepaticus

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CONTROL

- Antibiotics
  - Chlortetracycline 3-5 days
  - Lincomycin and spectinomycin
- Medium chain fatty acids (as preventive)
- Good husbandry
- Vaccine ??

MAREK DISEASE VACCINATION

H&N INTERNATIONAL

MAREK DISEASE

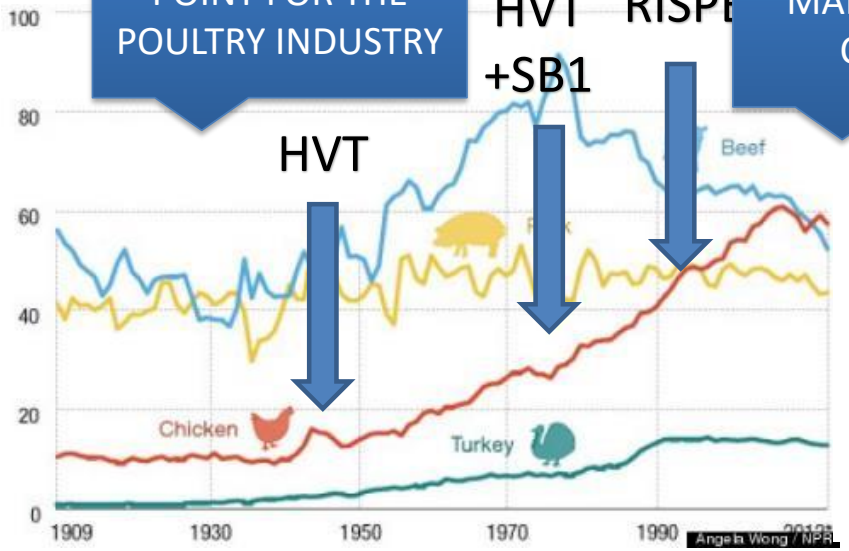
MAREK DISEASE CONTROL IS A KEY POINT FOR THE POULTRY INDUSTRY

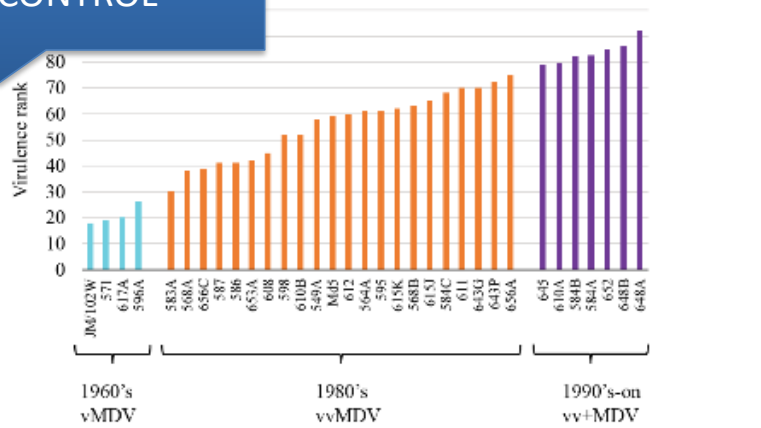
HVT

HVT +SB1

RISPE

VACCINATION IS A KEY POINT FOR THE MAREK DISEASE CONTROL





v=virulent, vv=very virulent, vv+=very virulent plus

From: R.L. Witter. Increased virulence of Marek's disease virus field isolates. Avian Diseases, 41:149-63, 1997.

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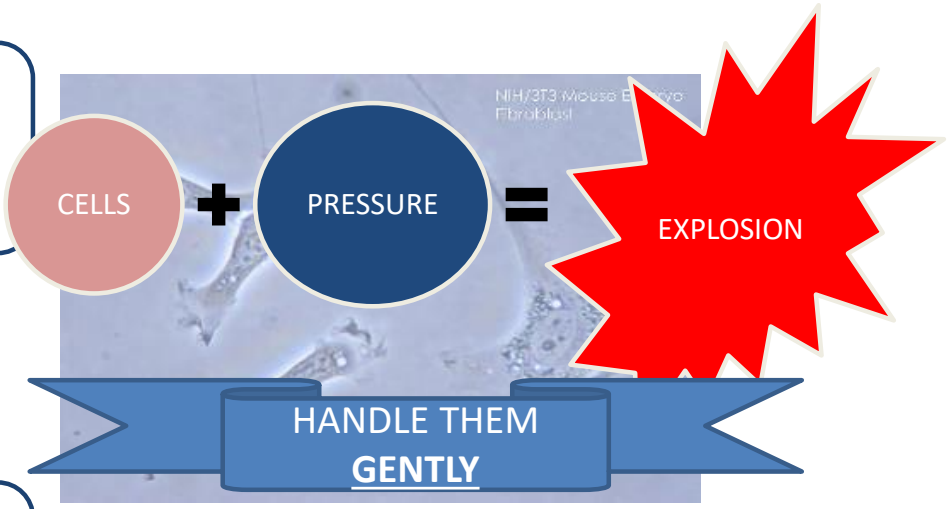
MAREK DISEASE

Marek vaccines are cell-associated vaccines so:

- Vaccine virus is grown in tissue culture
- Living cells are harvested and frozen in liquid nitrogen
- Cells must maintain their viability otherwise virus is inactive



Marek immunity is very complicated but some facts are clear:

- If birds are vaccinated after field virus challenge, vaccination will fail
- Biosecurity is key to allow the vaccine to stablish protection

MD VACCINES

Vaccine viruses commonly used belong to:

- Serogroup 1: Rispens ← The Most protective strain
- Serogroup 2: SB-1 ← It should be combinate with HVT
- Serogroup 3: HVT ← The least protective strain

Every commercial vaccine is unique →

Some combinations of MD are possible and positive but be cautious →

- NEVER MIX r-HVT AND HVT

Mixing MD vaccine with other vaccines, antibiotics or additive can affect to the vaccine effectivity →

Follow strictly manufacturers indications

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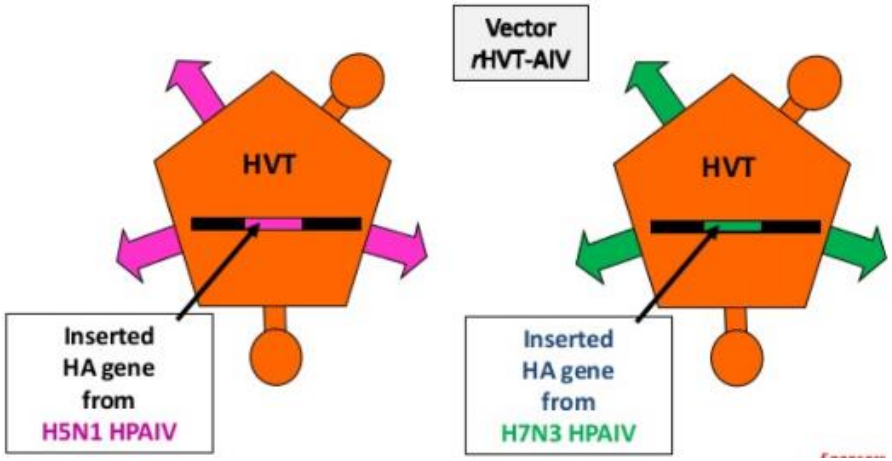
HVT vectored vaccines

One virus (the vector) is used to express, by insertion of the genes relevant for protection against a second virus (the donor), antibodies also against this second virus (the donor) by multiplication of the vector in the vaccinated bird.



1. Donor virus never enter in contact with birds
2. It can be applied at hatchery (HVT vector)

1. No specific local immunity for the donor virus
2. Different rHVT can not be combine

NEVER CUT D

DON'T WORRY. I AM SURE THAT HE IS NOT HUNGRY

CUT SEQUENCES:

1. N AT VACCINE
   W
2. N INATION
   P

H&N INTERNATIONAL

MD VACCINATION: STORAGE

Cell associated MD vaccine should be stored in liquid nitrogen

Liquid nitrogen levels should be checked periodically and record

Diluent must be stored properly

- Diluent should be clear, not cloudy
- Do not store at over 27° C

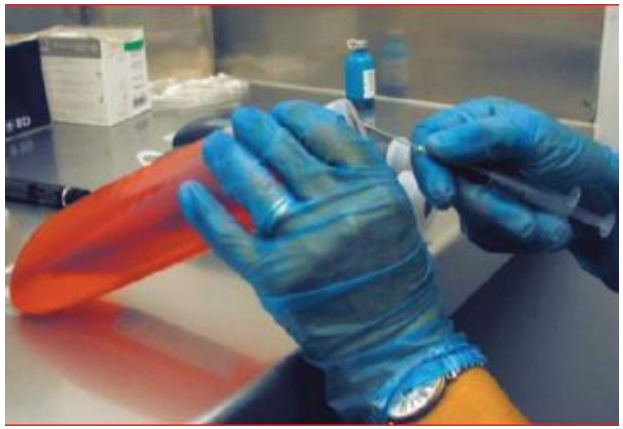
H&N INTERNATIONAL

MD VACCINATION: THAWING

- Only expose the ampoules that are going to be used immediately
- Thaw the ampoules in a 27 C water bath
- Use distilled water and keep it clean
- Gently swirl in bath for 60 seconds
- Complete melting process in 90 sec or less

H&N INTERNATIONAL

MD VACCINATION: PREPARATION



- Use only sterile recommend vaccine diluent
- Use sterile gloves to manage the vaccine
- Use needles18 gouger o wider to remove the vaccine from the ampoule
- Rinse the ampoule with diluent to ensure that all vaccine is transfer
- Mix vaccine and diluent gently
- Record the time the vaccine has been reconstituted

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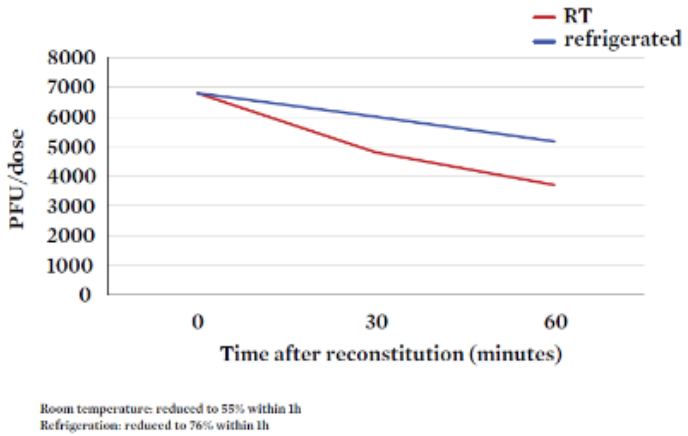
MD VACCINATION: ADMINISTRATION



- The vaccine titer will decrease from the moment of preparation
- Maintain vaccine under refrigeration
- Use the vaccine for no longer than 60 minutes
- Mix gently the diluent/vaccine every 15 min

By hand

By automatic machines

In ovo

MD VACCINATION: ADMINISTRATION

By hand

- SC (neck) / IM (leg) injection
- Injection volume depends on manufacturer (Normally 0,2 ml)

Automatic machines

- Vaccination in the same process of beak treatment
- Normally SC injection in neck

In ovo

- Better protection
- During the transfer

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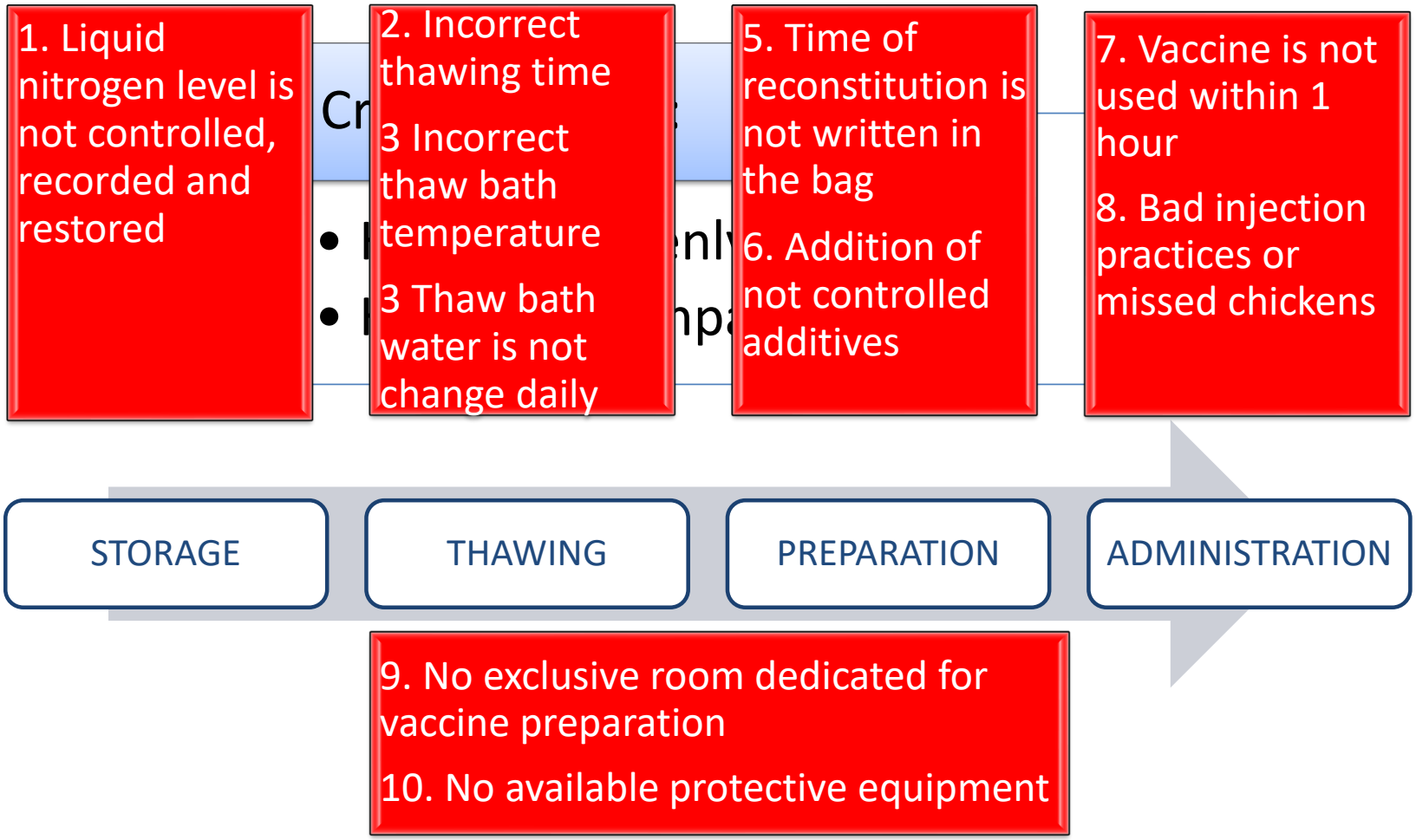
MD VACCINATION: PROCESS REVIEW

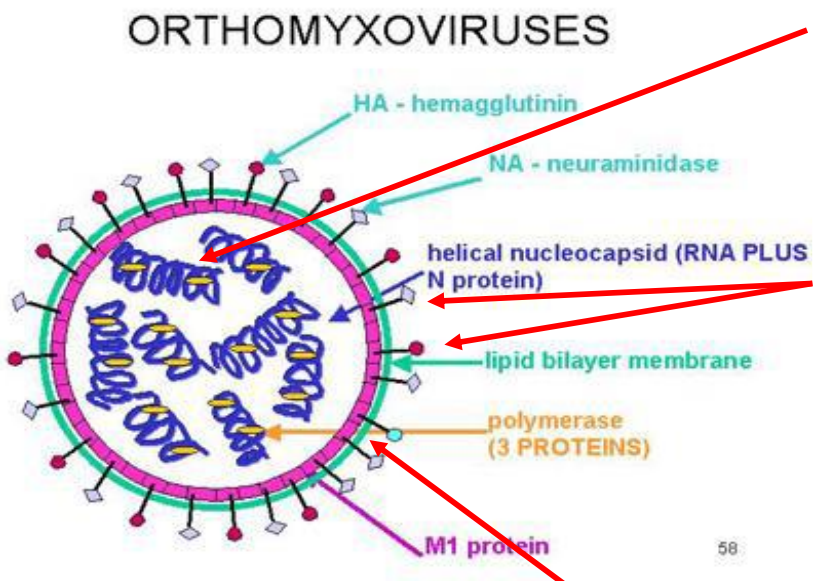


H&N INTERNATIONAL

The key to your profit!

Avian influenza

AI VIRUS



8 segments of single-stranded, negative-sense RNA:

- High mutation rate (RNA)
- High recombination capacity (8 segments)
- Lord of change !!!

2 main surface proteins:

- Hemoaglutinase (1 - 16). Highly related to the pathogenicity.
  - H5 H7: normally High pathogenic
  - All the other: low pathogenic
- Neuronidase (1 -9)

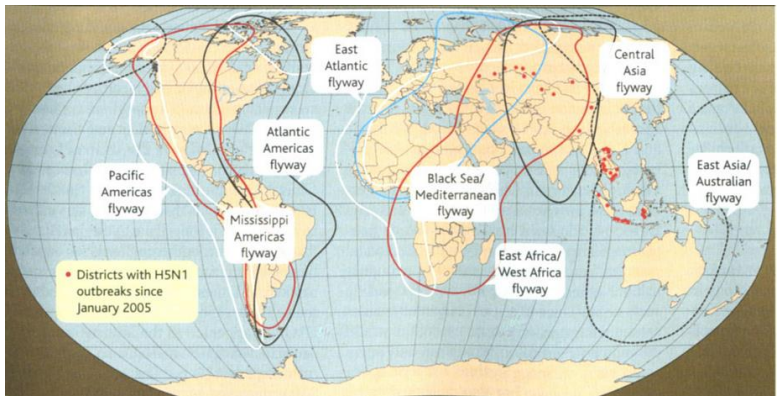
Enveloped virus by a lipid bylayer

- Relatively unstable in the enviroment
- Sensible to heat, pH, dryness, detergent and chemical disinfectant
- High survival capacity in water

H&N INTERNATIONAL

AI RESERVOIR & SPREAD

- Wild aquatic birds
- Majority are represented by two Orders
  - Anseriformes (ducks, geese, and swans)
  - Charadriiformes (gulls, terns and shorebirds)



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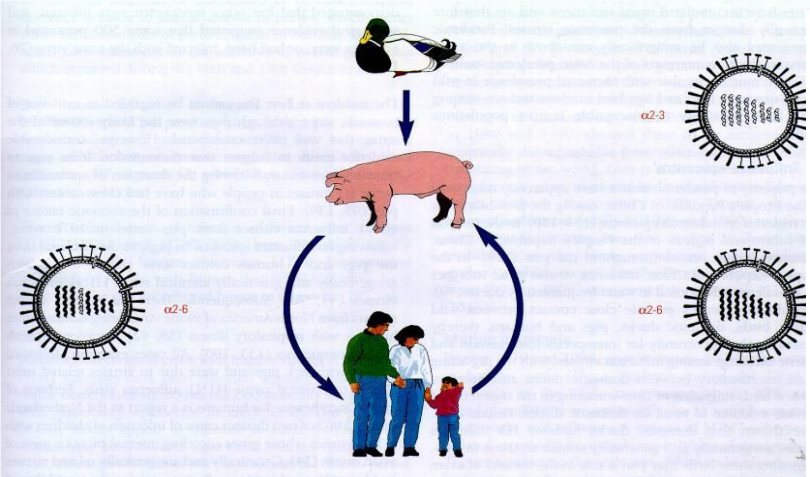
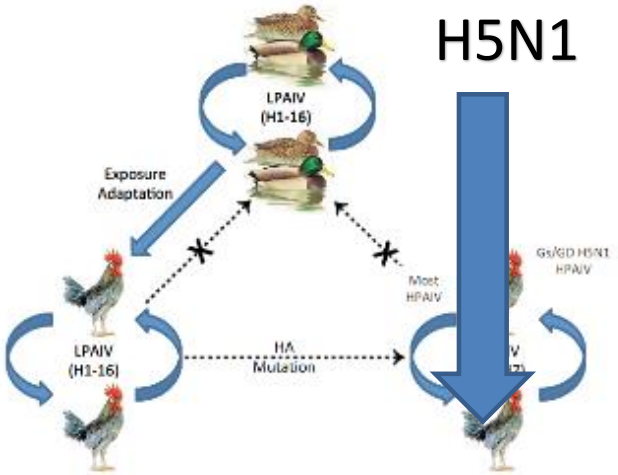
AI ECOLOGY





Modified from Swayne 2008

Hemagglutinin (H) Subtypes:

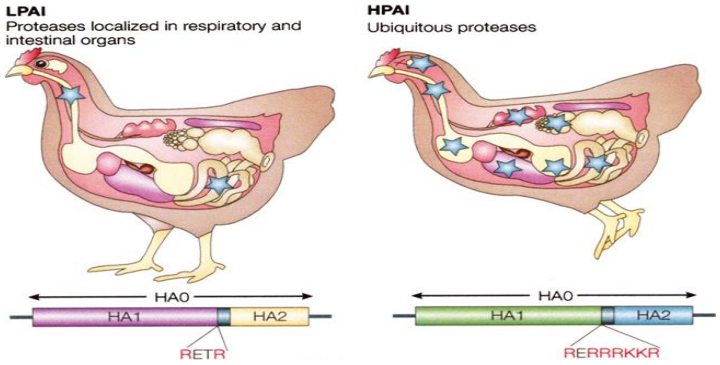
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Human	●	●	●		±		±		±							
Equine			●				●									
Swine	●		●	±	±				±							
Avian	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

Neuraminidase (N) Subtypes:

	1	2	3	4	5	6	7	8	9
Human	●	●					±		
Equine							●	●	
Swine	●	●				±			
Avian	●	●	●	●	●	●	●	●	●

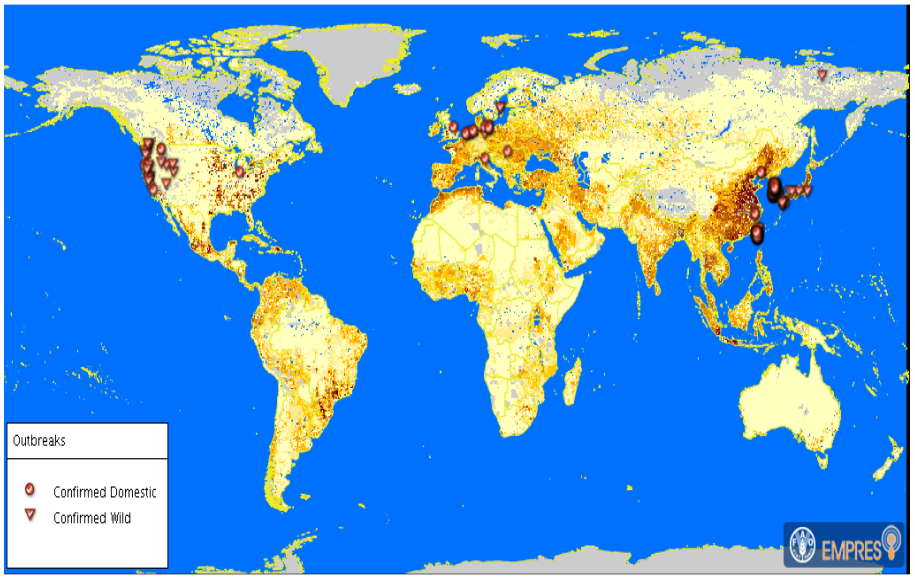
H&N INTERNATIONAL

LPAI VS HPAI



Wahlgren 2011

HA	H1-H16	Only H5 & H7
Infection	Only in respiratory and intestinal gut	Systemic
Clinical signs	• High morbidity (>50%) and low mortality (<5%). • Asymptomatic Or mild respiratory Signs with lethargy, decreased consumption. Bird in production: - Egg lay drop (10-50%) - Decreased egg quality • Replication can be systemic and mortality higher if young birds, or if concomitant pathogens or if stressed birds	• Acute disease, Very high mortality rates(100%). • Multiorgan failure. • Birds in Egg production - Decreased or cessation of egg production - Decreased egg quality



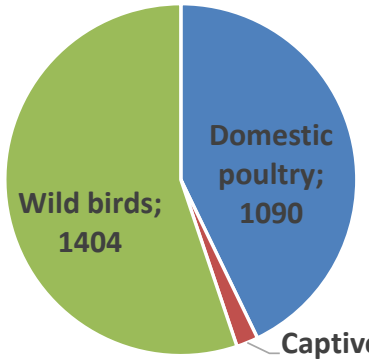
H5N8 outbreaks in 2014-2015

H5N8 HPAI

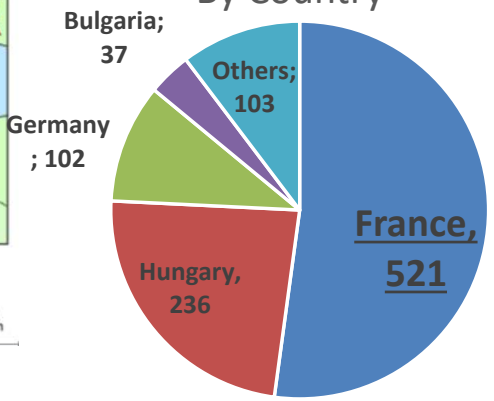
- The first outbreak report in domestic ducks was in South Korea on January 2014
- In Europe, the first affected holding was reported on the 4 November 2014 in the Mecklenburg-Vorpommern (Germany)
- To date, there have been no reports of human cases
- Highly pathogenic even for ducks and wild birds

HPAI H5N8

By type

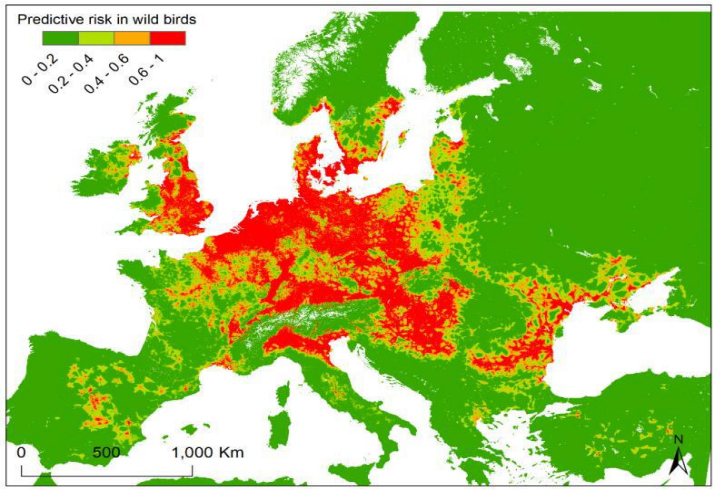


By Country

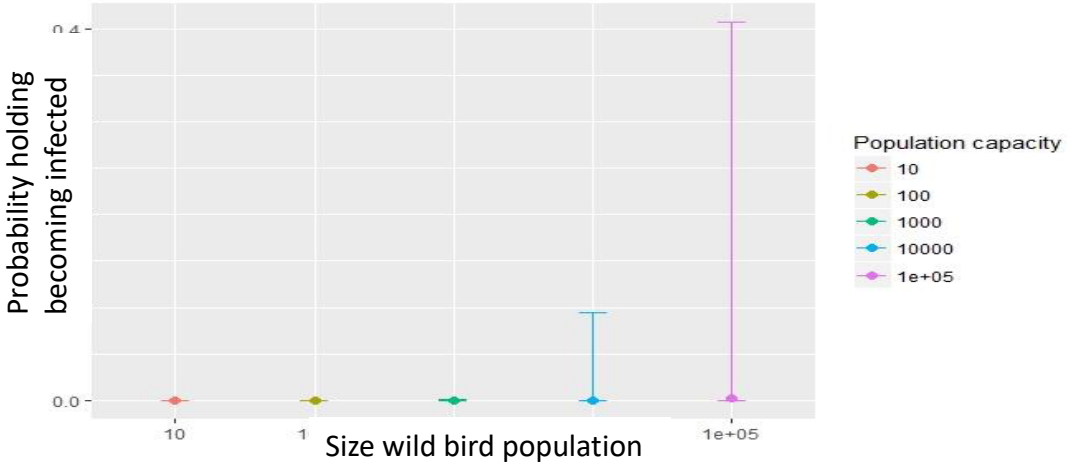


ELD | EUROPEAN LAYER DISTRIBUTION

Avian influenza



EFSA Journal



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HPAI LESION

Spectacular lesion but laboratory analysis needed to confirm diagnostic

H&N INTERNATIONAL

AI DIAGNOSTIC

- PCR
- Virology
- Serology (surveillance)

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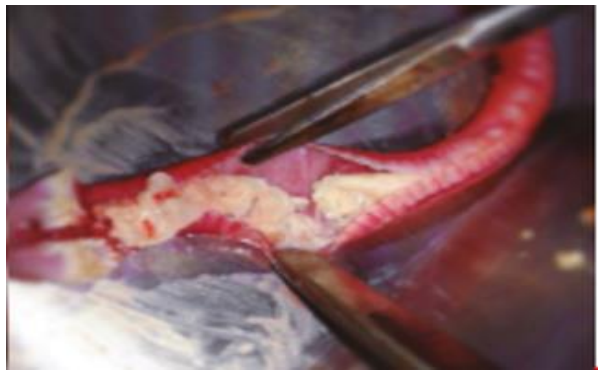
LPAI in Morroco

H9N2 LPAI

- Presence in North Africa, Middle East and Asia. Presence in Morocco since 2016
- Low pathogenicity strain but strong impact in birds:
  - Breeders:
    - Flocks from 1 to 5 weeks old: High mortality
    - Flocks in production:
      - Mortality: 8-9%
      - Egg production drop: 30-70%
      - Fertility drop: 6%-10%
- Vaccination protect against clinical signs but not avoid disease spreading



INTERNATIONAL

AI CONTROL

- **1.** Education
- **2.** Biosecurity
- **3.** Diagnostics and Surveillance
- **4.** Elimination of infected poultry (stamping-out)
- **5.** Decreasing host susceptibility (immunity against AIV):
  - Vaccination
  - Maternally derived antibodies (MDA)

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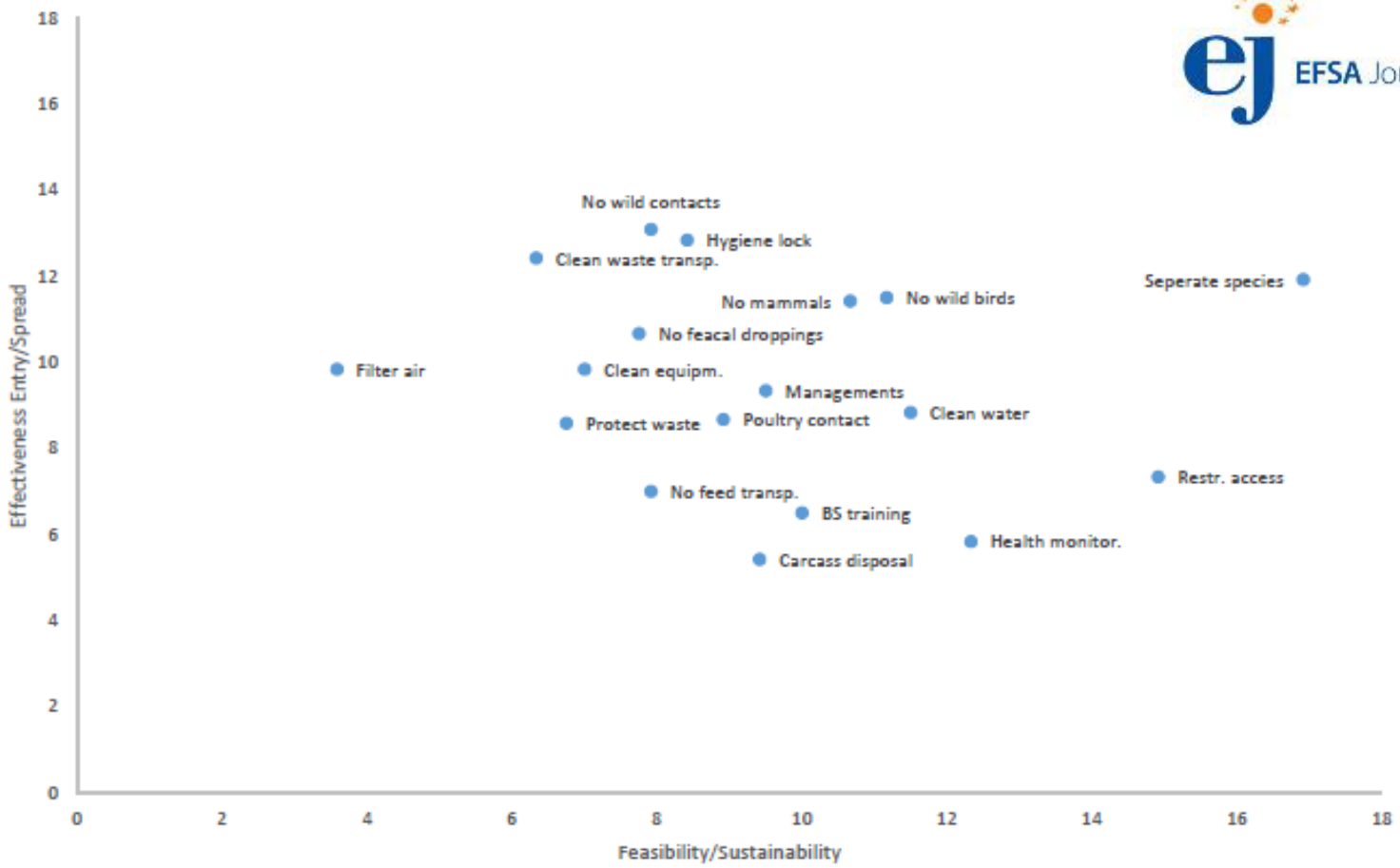
BIOSECURITY

Average ranking criteria for the Production Zone



EFSA Journal

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VACCINATION

- AI vaccines
  - Oil-emulsified inactivated whole AIV
  - Recombinant live virus vectors with AI HA gene insert
- AI vaccination program
  - Specific prime 2 doses protocols as minimum
  - Long life birds should be re vaccinated for maintaining protective immunity (each 6 months?)

STRENGTH	WEAKNESS
Increase resistance to AIV infection Reduce replication of AIV in respiratory & GI tract Prevent illness and death in poultry Reduce transmission to birds and humans	Do not prevent infection Do not prevent shedding Protect from field viruses within the same hemagglutinin subtype Make monitoring much more complicated (DIVA)

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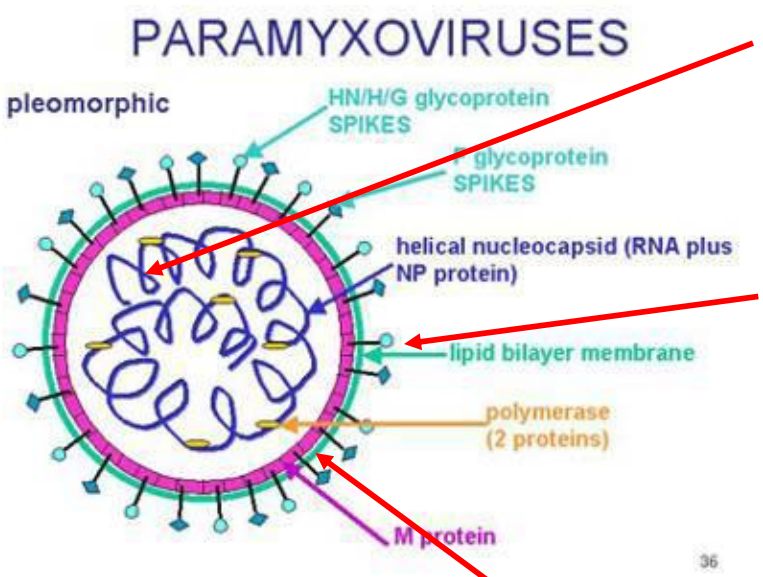
NEWCASTLE DISEASE

ND VIRUS



1 segments of single-stranded, negative-sense RNA:

- More stable virus!!!

1 main surface protein1 (H/N):

- Less antigenic variability
- Only one serotype

Enveloped virus by a lipid bylayer

- Relatively unstable in the enviroment
- Sensible to heat, pH, dryness, detergent and chemical disinfectant

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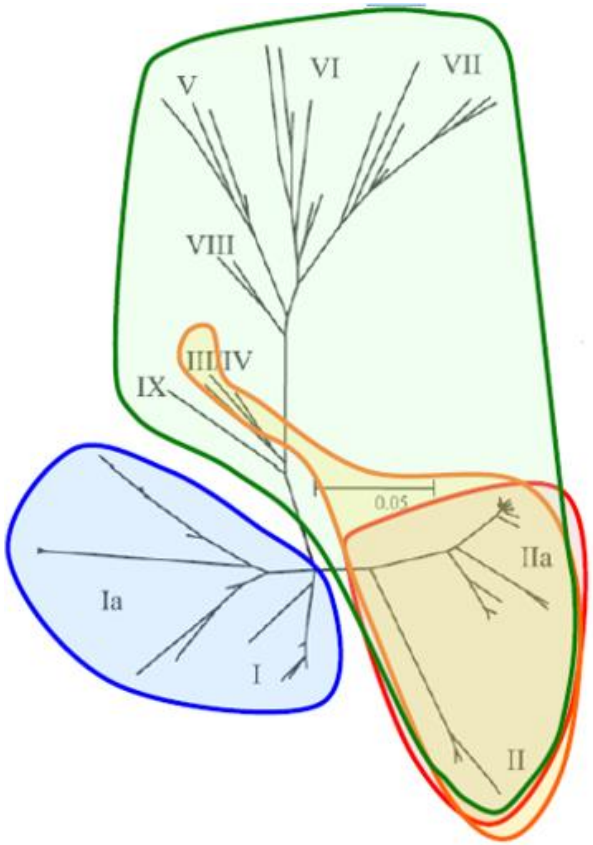
Classification of NDV strains



Source: T Van der Berg

- **Velogenic** (in green): Until 80% mortality
  - Neurotropic (II)
  - Viscerotropic (III-IX)
- **Mesogenic** (in orange) Until 10% mortality. Respiratory sign
- **Lentogenic** (in red) Mild or inapparent respiratory sign
- **Apathogenic** (in blue)

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ND CLINICAL SIGNS AND LESION

- Drop in egg production
- Edema of head, especially around eyes
- Greenish-dark watery diarrhea
- Respiratory and neurological signs

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ND Control

- BIOSECURITY
  - Same programs as in AI
  - Pay attention to dead birds and manure
- VACCINATION
  - Good immunity will protect against the clinical sign and shedding
  - Live and inactivated vaccines available
  - One serotype

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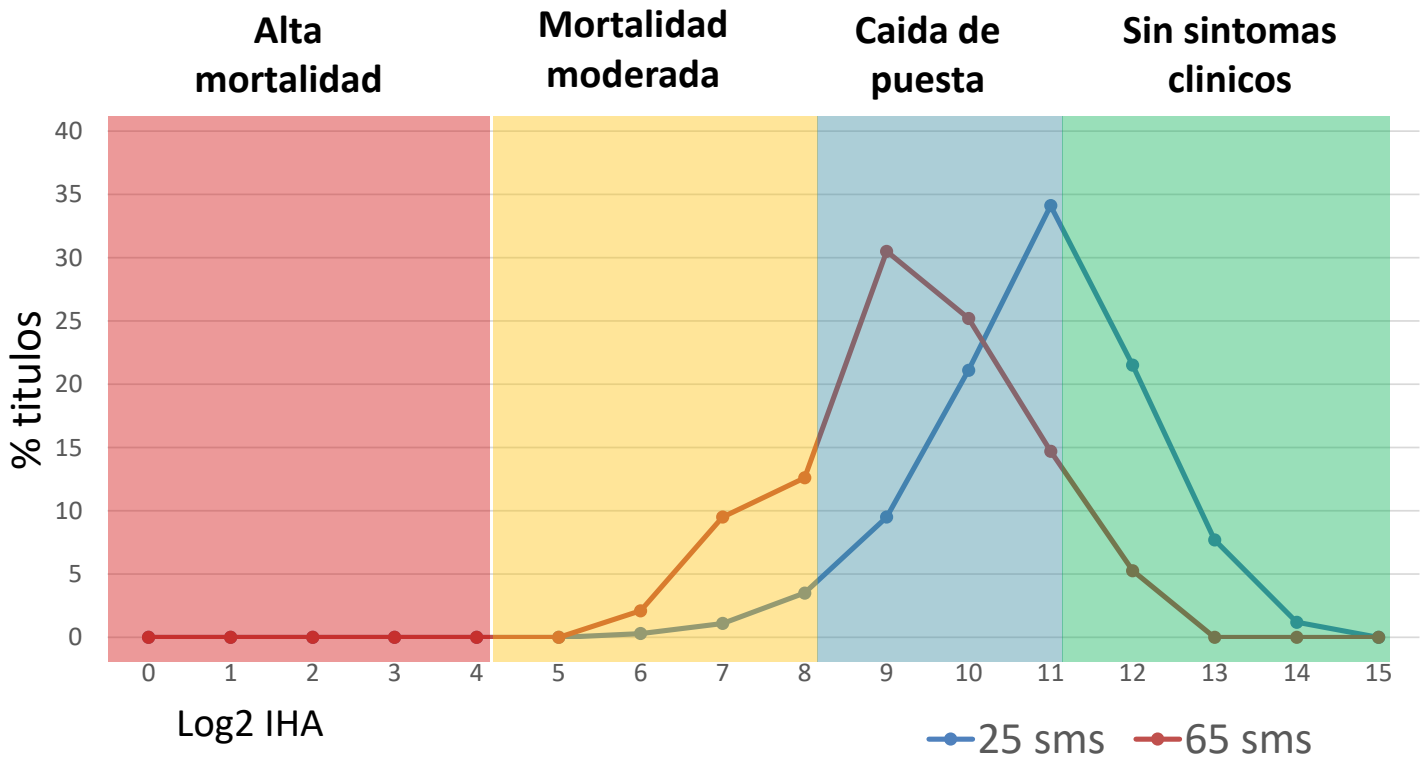
Vacunacion

Títulos de anticuerpos contra ND tras programa de vacunación de dos vacunas vivas y una inactivada en levante + no revacunación en producción



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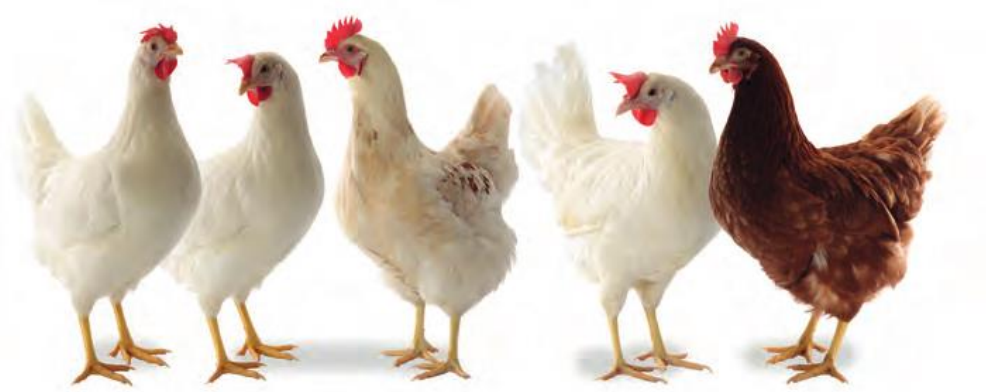
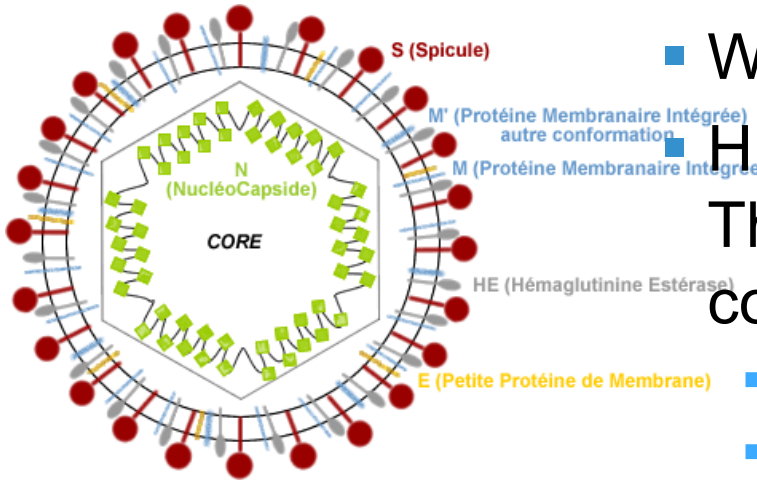


Infectious bronchitis

Infectious bronchitis



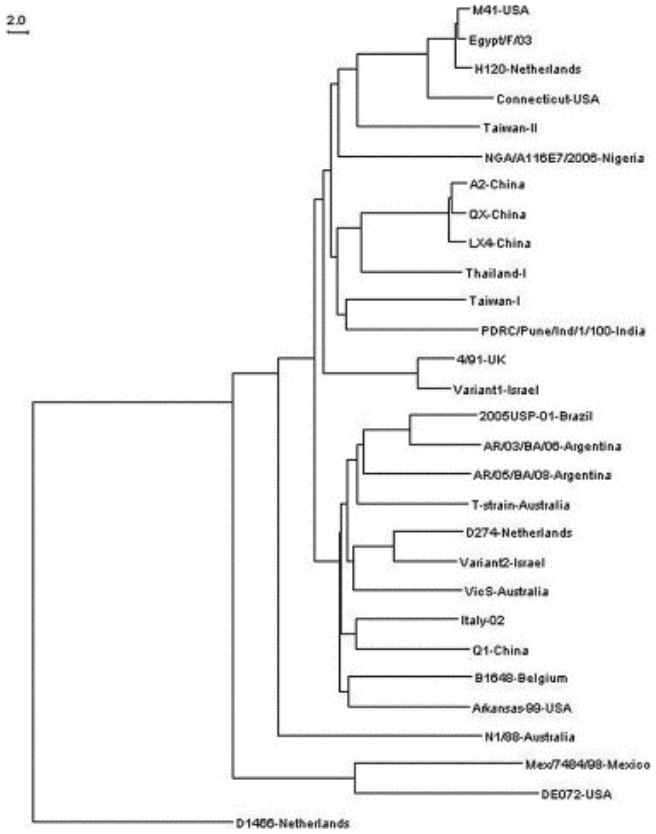
- A coronavirus; single- stranded RNA virus
- Worldwide importance
- Huge capacity to mutate. Therefore able to change continually by:
  - random mutation
  - genetic recombination
- A highly infectious disease of chickens of all ages and type

H&N INTERNATIONAL

IB SPREAD

- Transmission of IBV:
  - Highly infectious
  - Spread by aerosol and faeces
  - May persists in the chicken for many weeks
  - May survive in litter for many days •

IB VARIANTS



- Result from mutation or genetic mutation
- A new variant is recognised in the laboratory by:
  - Serotyping (traditional method)
  - Genotyping (increasingly used)
- Different pathotypes

H&N INTERNATIONAL

IB CLINICAL SIGN & LESIONS

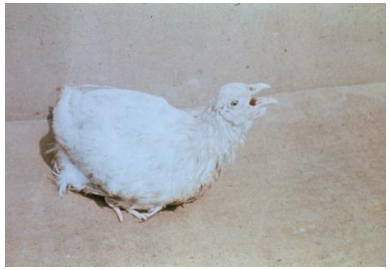
1. Primary infection site – upper respiratory tract

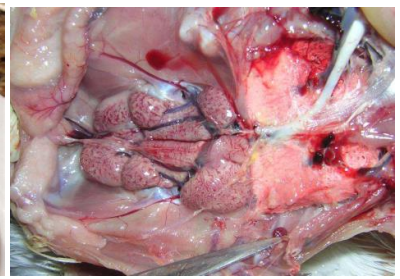
1-21 days

Early infection:
- Hidroponic oviduct

> 21 days

Late infection:
- respiratory disease
- nephropathogenic
- alteration of the reproductive organs





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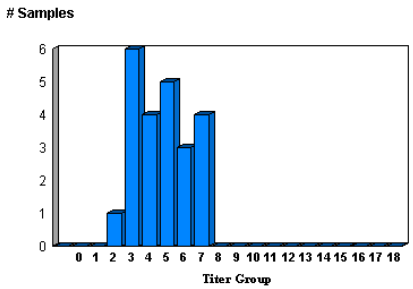
IB DIAGNOSTIC

Diagnosis:

- Virus isolation in embryo culture
- PCR
- Antibody detection:
  - AGP and ELISA: group specific
  - HI and SN: serotype specific



Assay : IBV **Lot:** FS4918
Bleeding Date : 25-08-2009 **Testing Date:** 25-08-2009

Mean Titer:	5 297		
Min. - Max Titer :	2 939	-	9 863
G.M.T.:	4 985		
%CV :	37		
Target Titer:	**1 000**	-	**2 000**
Target %CV:	**40**	-	**70**
VI Index:	**143**		
VI Target Range:	**10**	-	**90**
Interpretation VI Index:	**HIGH**		

Details Vaccination Program:

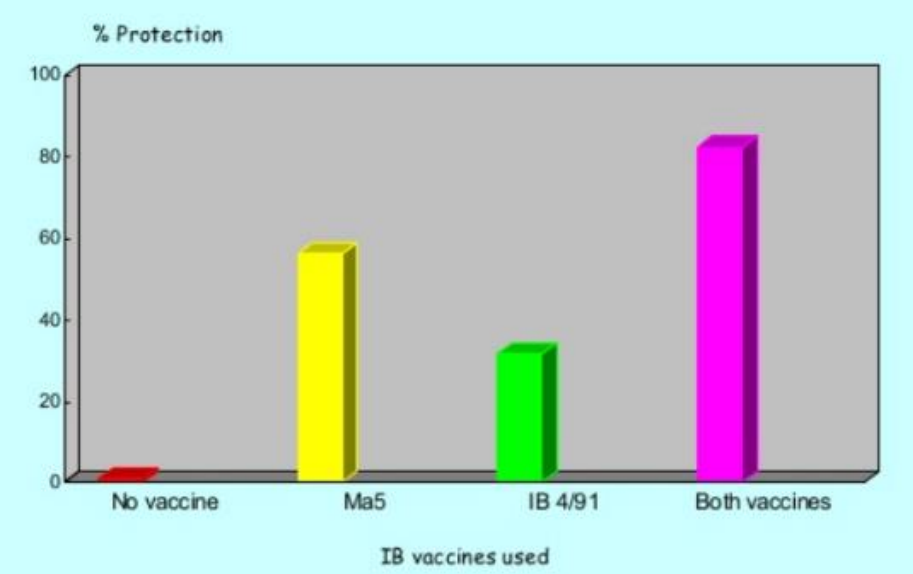
Vaccine	Method	Age	Vacc.Batch/Applicator
H120	SPRAY	01D	
H120	DR. WATER	09D	/

Titer Range Ref. Controls:	CR.(4500-8000) ; F1 (1000-4000) ; R8 (2000-6000)
Mean Titer Ref. Controls:	CR= 6301 ; F1= 1766 ; R8= 4334

IB CONTROL

- BIOSECURITY
  - Corner stone but not enough!!!
- VACCINATION
  - Live and inactivated vaccines available
    - 2 or 3 live vaccines + inactivated vaccine
    - Use different strains if available → protectotype
    - Protect chicks from day 1 !!!

PROTECT TYPE CONCEPT



Source: J. Cook

- Use two or more highly immunogenic and not related vaccines
- Variant vaccine are said to provide a better protection against similar field virus
- BUT real protection is only know after lab or field trials

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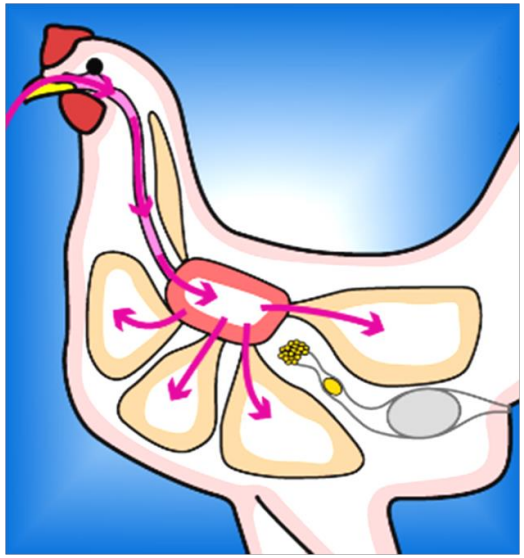
MYCOPLASMOSES

Mycoplasma gallisepticum

- Class mollicutes (No wall)
- Extremely resistant in the host.
- Very unstable in the enviroment
- Typically associated with CRD in laying hens with another virus or bacterias (E. Coli)

MG SPREAD



- Vertical transmission can also occur in eggs laid by infected hens
- Pulsatile excretion

Feed: 4 hrs
Cotton: 4 days
Feathers: 4 days
Hair: 3 days
Straw: 2 days
Rubber: 2 days
Nose: 1 day
Wood: 1 day
Shavings: 8 hrs
Ear: 4 hrs
Skin: <4 hrs

The route of infection is through the upper respiratory tract and/or conjunctiva

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MG CLINICAL SIGN & LESION

- Drop in production
- Egg shell thickening
- Depression
- Rales, Coughing, Sneezing, Nasal discharges

MG CONTROL

- BIOSECURITY
  - PS should be remain uninfected
  - Biosecurity level should be improved
- VACCINATION
  - Live and inactivated vaccines available
- ANTIBIOTHERAPY
  - MG is sensible to many AB (Tetracyclines, macrolides, …)
  - AB treatment will decrease clinical sign for a time
  - Infected bird WILL continue as carrier in spite of AB treatment

H&N INTERNATIONAL

MG Vaccines

	Ability to Spread	Antibody response	Pathogenic to turkeys	Route of Administration
Bacterins	No	+++	No	Injection
F-strain	Yes	++	Yes	Spray/Eyedrop
6 / 85	No	-	No	Fine spray
TS - 11	No	+	No	Eyedrop

Source: A. Mazaheri

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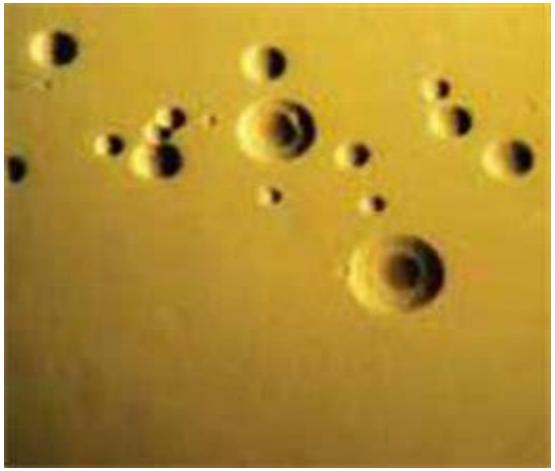
MYCOPLASMA SYNOVIAE



- Causes infectious synovitis and respiratory disease
- Pathogenicity depending on the virulence ant tropism:
  - Strain apathogenic alone
  - Strain affecting respiratory tract
  - Strains affecting synovial membranes
  - Strains affecting oviduct

H&N INTERNATIONAL

LESION CLINICAL SIGN & LESION

- Respitory tract
- Articular lesion with amyloid
- Keen bone bursa inflammation
- Abnormal apex eggs

MG APEX ABNORMAL EGGS

- Up to 10% AA eggs
- Decreaded egg size
- Egg shell thickening

MS CONTROL

- Same as in MG control!!!
- Different vaccines available

Vaccine	Strain	Route of administration	Storage
Vaxsafe MS-HH	MS-H	Eye droplet	Dried ice
Nobilis MS Live	MS1	Spray	2-8 C

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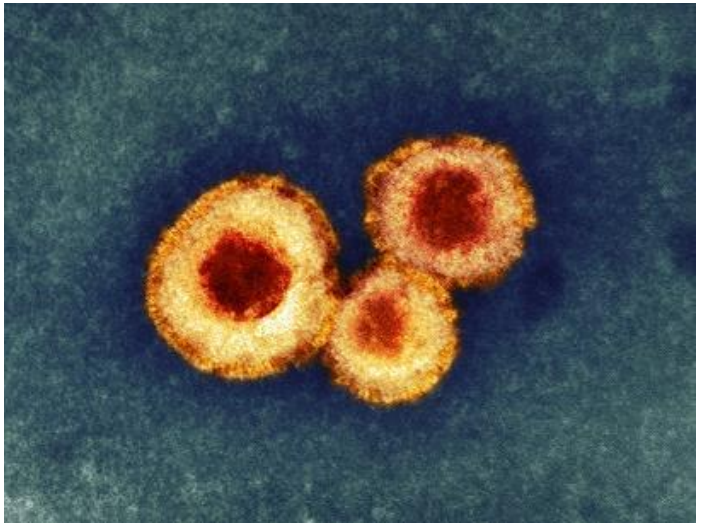
The key to your profit!

AVIAN PNEUMOVIRUS

AMPV



- Avian metapneumovirus
  - Related to Paramixovirus
  - Two serotypes in Europe (A and B) and one more in NA (Colorado)
- Highly pathogenic in turkeys
- Some strain causing pathology in chickens
- Role in respiratory health

AMPV

- Swollen head syndrome → in turkeys not so clear in hens
- Production drop
- White eggs in brown layer

AMPV

- BIOSECURITY
- VACCINATION
  - Live vaccines (1-3 doses depending on field challenge) + inactivated (1 doses)
  - Vaccine strain from turkey and hens isolated virus
  - Good cross protection between serotypes

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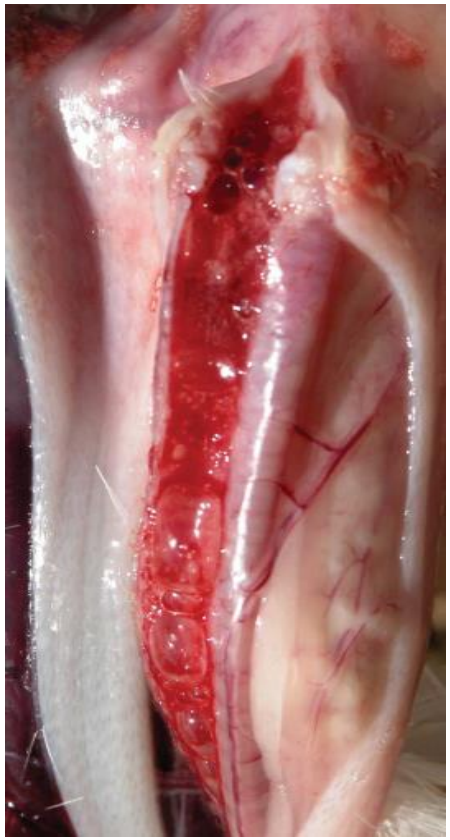
INFECTIOUS LARINGO TRACHEITIS

ILT



- Gallid Herpes virus causes respiratory disease in chickens
- Highly contagious
- Highly virulent
  - Mortality up to 50%
  - Egg drop
- Lesion in trachea
- Virus can remain latent in infected birds for life

H&N INTERNATIONAL

ILT CONTROL

- BIOSECURITY
- VACCINATION
  - CEO vaccine can revert to virulence

Vacuna	Virulencia	Protección	Reacción	Vía	Inicio de Protección	Costo
CEO	+++++	+++++	+++	Ind./Mas.	10 d	$
TCO	++	++++	++	Ind.	14 d	$$
HVT-LT (1)	-	+++	-	Mas.	28 d	$$$
HVT-LT (2)	-	++	-	Mas.	28 d	$$$
POX-LT	+	+	+	Mas.	21 d	$$$
Inactivada	+	-	+	Ind.	?	$$

Source: G. Zabala

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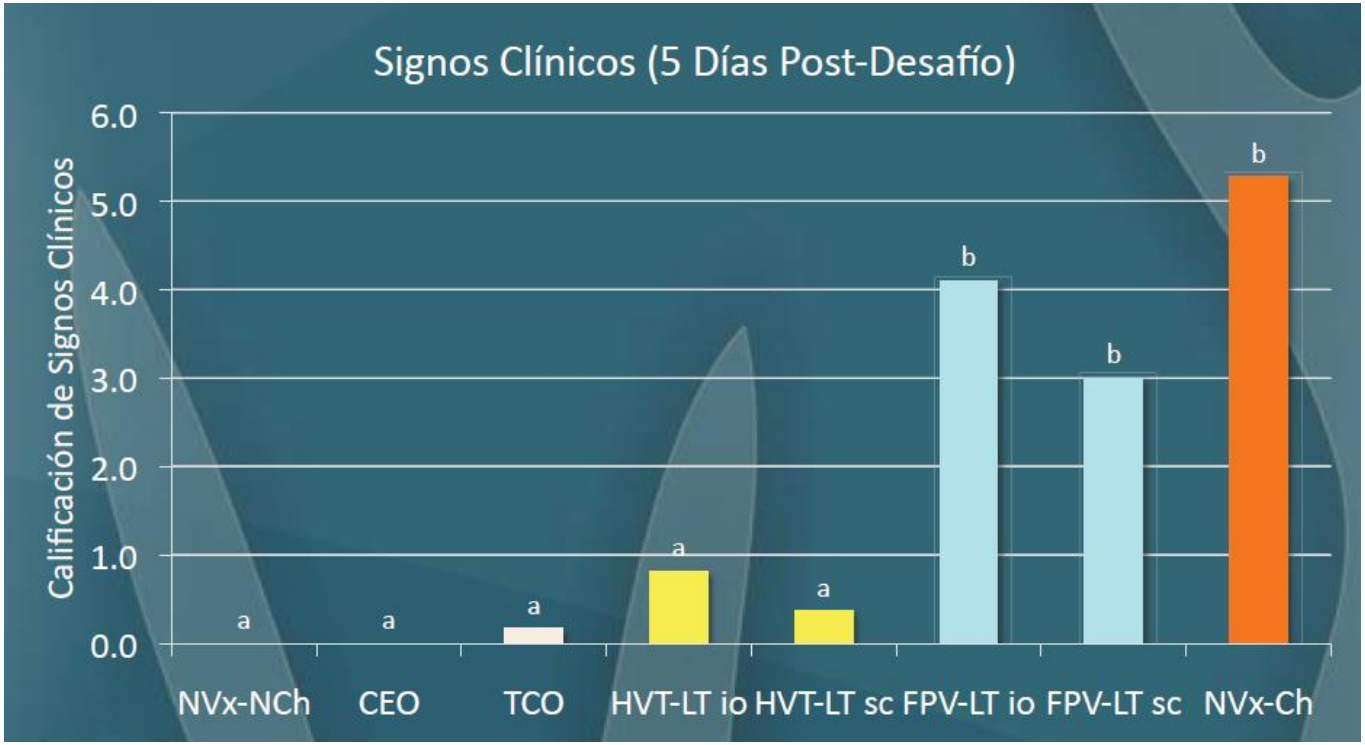
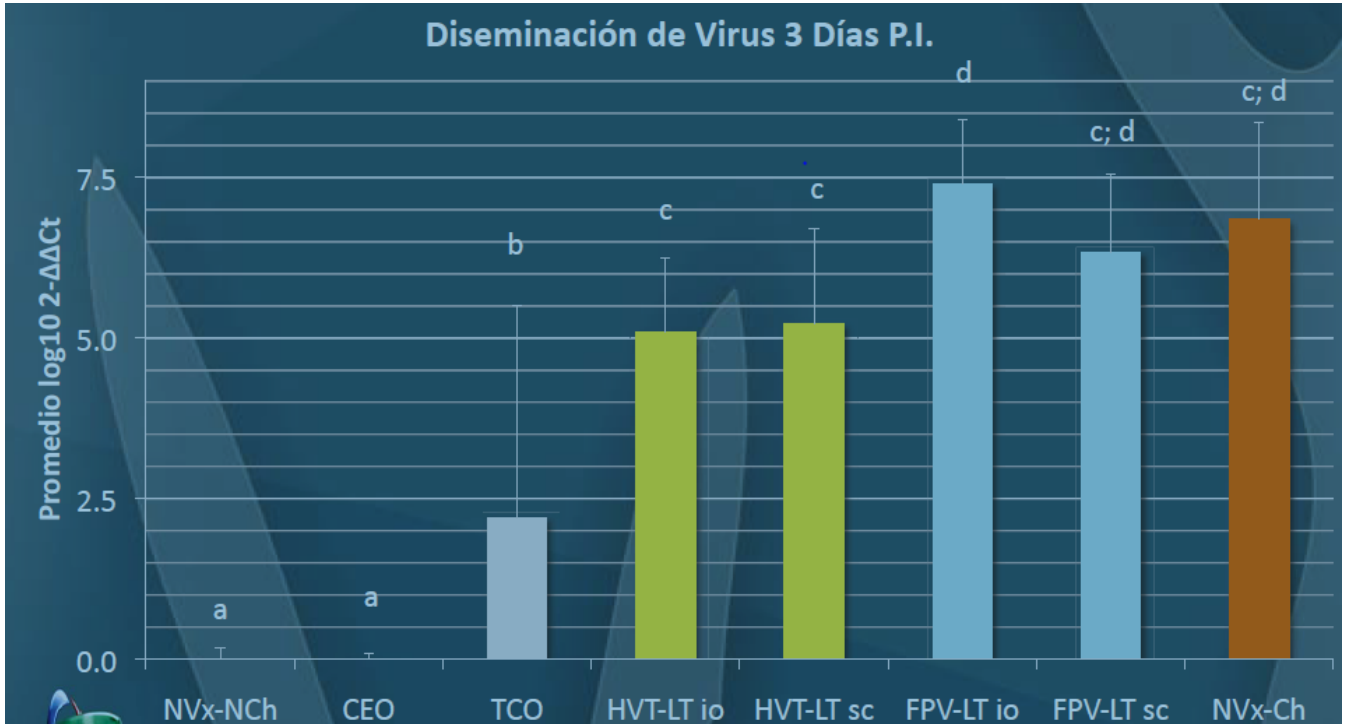
ILT CONTROL



Source: G. Zabala

ILT CONTROL



Source: G. Zabala