

# Teaming up for animal health

In the interest of animals, their owners and society at large





# Poultry Health Seminar

Preventive measures & Gut health

Robert Jan Molenaar, DVM, FRCPath





# Seeing more by looking more closely



Ask the following questions:

What am I seeing, smelling of  
feeling

Why is this happening?

What should I do?





Too HOT



Too COLD



Extra feed



Extra water



# DOC – before arrival



Water temperature	Effect
< 5 °C	Reduced intake of water
18-21 °C	Perfect
> 30 °C	Reduced intake of water
> 44 °C	Won't drink

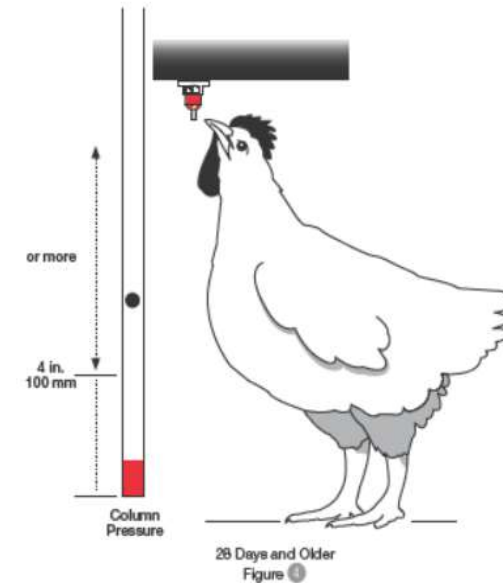
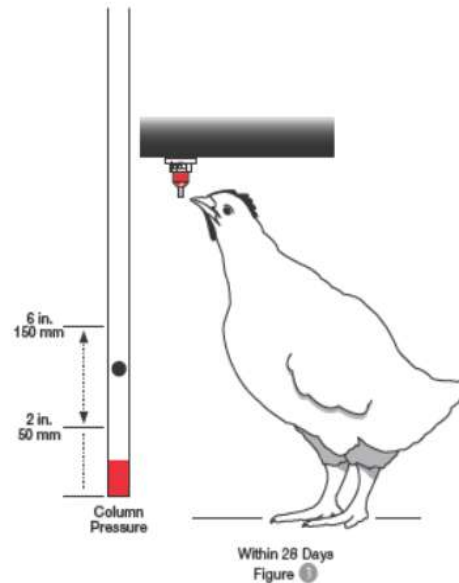
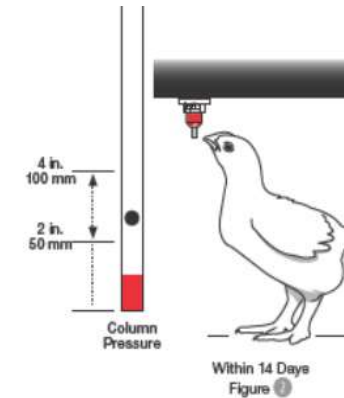
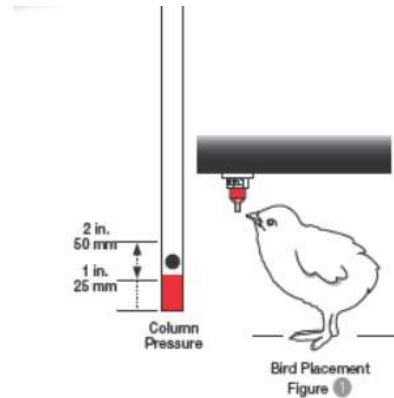
Note: during the **application of live vaccine through the drinking water**, do **NOT** adhere to these temperatures



# water



- Flow rate nipples
  - 0-7 days 20 ml/min
  - 7 -21 days 50 - 70 ml/min
  - > 21 days 70 – 100 ml/min
- Nipple height
  - Angle of chicken:
    - Chick: 35 to 45°
    - Growing: 75-85°
  - Straight head: reaching, not stretching
- Number of visits: 65-128





# Navel scoring





# Navel scoring



- Score 0 = closed, clean navel
- Score 1 = not completely closed, small button (<2mm) or lint
- Score 2 = open navel or large button (>2mm), wet, soiled, discoloured navel and/or soft, moist, mushy abdomen





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# Crop filling



>80% after 4 hours, 85% after 8 hours, 95% after 24 hours



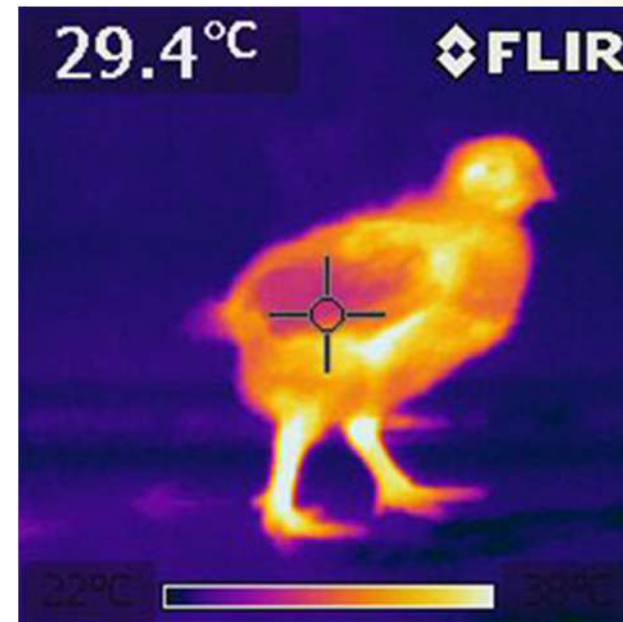
- Determine filling and consistency (→ feed and water intake)



# Cloacal temperature



- Adults: regulate their body temperature
- Baby chick: has to rely completely on environment (first 3 days)
- Measure temperature:
  - Outside temperature; changes rapidly
  - Internal temperature; useful!





# Cloacal temperature



- Measure temperature
  - Upon arrival = indication of transport conditions
  - At 4 hours after arrival
  - At 8 hours after arrival
  - Daily (upto 7 days)



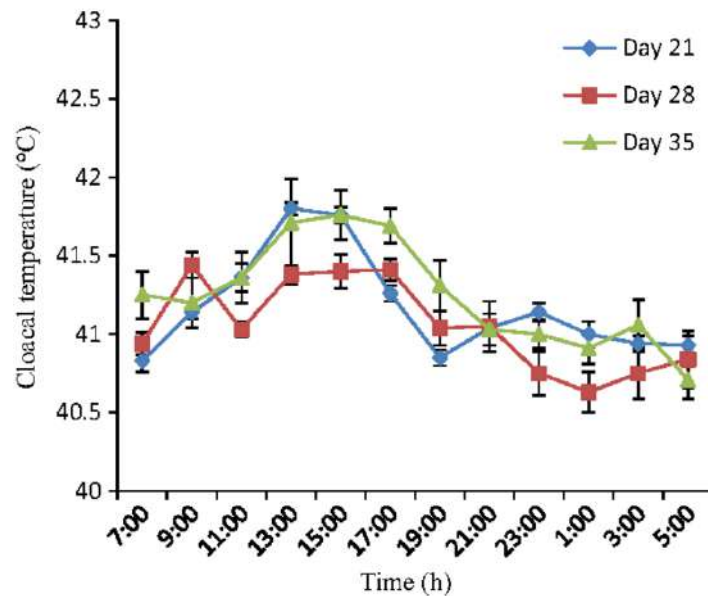


# measure



- Cloacal temperature and comfort zone

Age	Cloacal temperature
Day old chick- arrival	39,5 – 40,5
Day old chick – 4 hours	40,0 – 40,5
10 days	41,0 – 41,5





**During all of this: be gentle**





# DOC arrival

Abnormal behaviour / sign of disease

- Example: Vit B2 deficiency





- *Open beak with no additional noises*
  - High ambient temperature
  - Gasping for air found in chicks with an *Aspergillus* infection





- Natural chicken sounds
  - Clucking: lay, expectation of feed, frustration
  - Cackle: danger
  - Screech: fear, pain
  - Respiratory sounds
- Sound of the feeders
- Sound of the fans





# Respiratory sounds



- Expectoration
  - irritation of the nasal passage and the beginning of the trachea, with excessive mucus development,
    - poor climatic conditions and a secondary *E. coli* complication. If occurring acutely, then it is most likely a viral infection, such as infectious bronchitis (IB), AMPV or NCD.



# Coryza





# Avian influenza

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Production

Health

Behavior



# Look from large to small



Flock → Individual chickens → Parts of the chicken

What's going on here?



And here?





# Walking around



- Take a different route as the care taker.
- Walk across the flock
- Scare them:
  - make a noise, see how they react:
    - Walk away, and observe when stop
      - Turning around?
      - Sitting down?
  - Look behind you
    - Birds should fill the empty space directly





**Which one will take more feed**







*Bij het oppakken biedt een gezonde kip enige weerstand.*



*Een scherp uitstekend bot en te weinig bevezing, wijst op een te lage voeropname.*



*Hoor je afwijkende geluiden, kijk dan naar eventuele natte neuzen en in de keelholte of je slijm of andere tekenen van een ontsteking ziet.*



*Zwellingen van of korstjes op de voetzolen zijn een teken van nat of scherp strooisel of scherpe uitsteeksels.*



*Stijve of warme gewrichten zijn vaak ontstoken.*



*Is de ruimte tussen de legbotjes smaller dan twee vingers, dan legt de kip niet.*



## ‘Helicopter disease’

### **Runting and Stunting Syndrome**

or

### **Malabsorption Syndrome**

-Symptoms:

- Poor digestion feed
- Poor growth
- Abnormal feathering

-Cause:

- Multifactorial
- Infections (Reo, Astro, Rota, ??).

-DDx

- Mycotoxins
- Deficiencies





# Feathers





# Gut health and development



## **From approx. week 3 onwards:**

- Attention for the intestines; feed intake is rapidly increasing
- Passive and/or birds that are not alert, may have gut problems
- Should be well spread in the unit
  - If not, find the reason
- Daily gain accelerates to form skeleton, organs and muscle mass.
- At 7 days, a broiler may eat 20% of its bodyweight daily
- Too fast gain may lead to sudden death and susceptibility to diseases
  - Control by increasing dark hours and/or diluting feed.
- Vent pasting may occur due to change in feed
- Dark hours could be increased to 4 hours



# Gut health and development



- Signs from Droppings
  - Undigested feed residues





# Gut health and development



- Signs from Droppings
- Manure consistency





- Intestinal dropping
  - solid and has a grayish-brown color. It is in parts surrounded by a thin white layer of urates





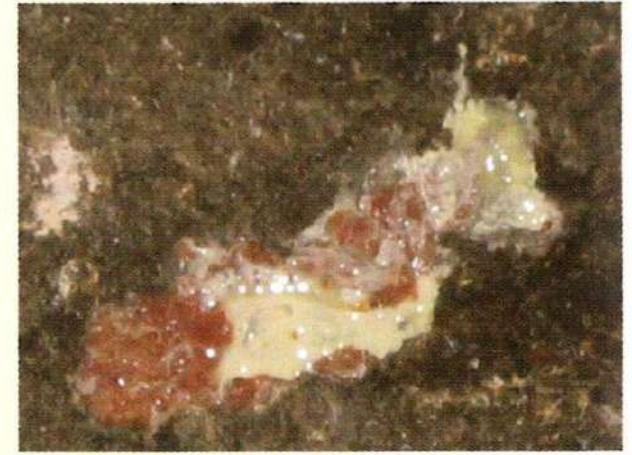
## Intestinal dropping



*Right*



*Reasonable*



*Not right*

Source: A. Slaats



# Caecal dropping



- Ceacal dropping
  - brownish-black





# Caecal dropping



*Right*



*Reasonable*



*Not right*



# Diarrhoea



- Watery dropping
- No correct shape
- Highly accelerated passage
- Necrotic enteritis
- Coccidiosis





# Bloody droppings



- Intestinal dropping
  - Blood around the dropping →
  - Epithelium (orange)?
- *Coccidiosis*
  - *E. tenella*
  - *E. necatrix*
  - *E. maxima*
- *Invagination*





# Foamy cecale dropping



- Yellow like dropping
- Foamy
- Gas formation during fermentation in the ceaca
- Accelerated passage
  - Dysbacteriosis
  - Brachyspira



Source: Broiler Signals



# Bile / urates



Source: Broiler Signals

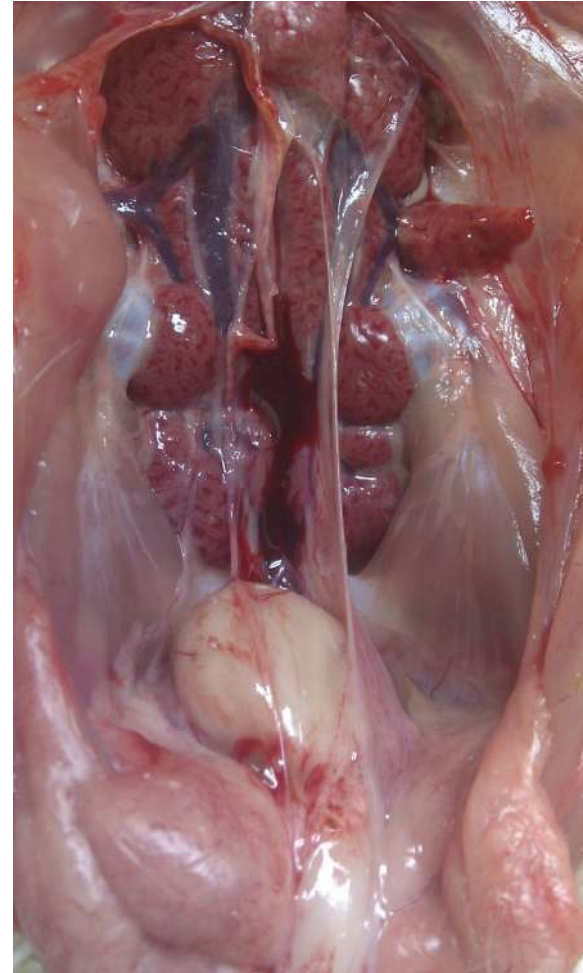
- Green dropping
- thin
- Highly accelerated passage
- Reduced feed intake
  - Newcastle disease
  - Avian Influenza
  - Gumboro/IBD
  - Acute septicaemia



# Kidney disease



Source: Broiler Signals





# Dark



*Dark droppings usually indicate bleeding in the first part of the intestinal tract. The blood is also digested and turns an almost black colour. But an excreted piece of the intestine can also look like this (a piece that has become trapped and dies off).*



# Undigested feed grains



*Lots of droppings and feed grains under a cage system. Digestion is very poor: feed and droppings are almost indistinguishable. The droppings are gel-like and greasy with clearly visible feed components.*



*You can even see maize in this very poorly digested dropping; normally this is the most easily digestible ingredient of chicken feed.*



## Week 3 Gut health and development



- Signs from Droppings
- Assessing the moisture content



### 1. Manually

Pick up a dropping and squeeze it. In this photo you can see that the pellet contains water. When you squeeze it, it drips: this is not right.



### 2. Paper

Lay out paper in the broiler house on which to collect fresh droppings. If large water rings appear round the droppings, as shown on the photo, there is a problem with the manure. It could be disbacteriosis.



# Gut health and development



- Risk at feed transitions
- Problems may appear a few days after as gut has to re-adjust
- Optimum management reduces risks
- Chicken prefer larger particles
- In mash feeding, vitamins, trace minerals are especially in smaller particles



## Week 3 Gut health and development



- Detecting stomach pain
- When lifting a chicken, feet should point forward
- Broiler at right lifts feet; could be early sign of stomach pain





# Feathers on the floor





# Aspecific intestinal disease - Diagnosis



## “Dysbacteriosis” evaluation

- Signs of decreased intestinal health

### **Avian Pathology**

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/cavp20>

### **Morphometric evaluation of “dysbacteriosis” in broilers**

E. Teirlynck <sup>a</sup> , M. D. E. Gussem <sup>b</sup> , J. Dewulf <sup>c</sup> , F. Haesebrouck <sup>d</sup> , R. Ducatelle <sup>d</sup> & F. Van Immerseel <sup>d</sup>



# Ballooning



Maldigestion

- Dysbacteriosis?

Loss of tonus

Artefact?

Leakage tight junctions?



Teirlynck *et al.* 2011 AvPath 40:2 pp 139-144.



## Abnormal contents



Foam (gas)

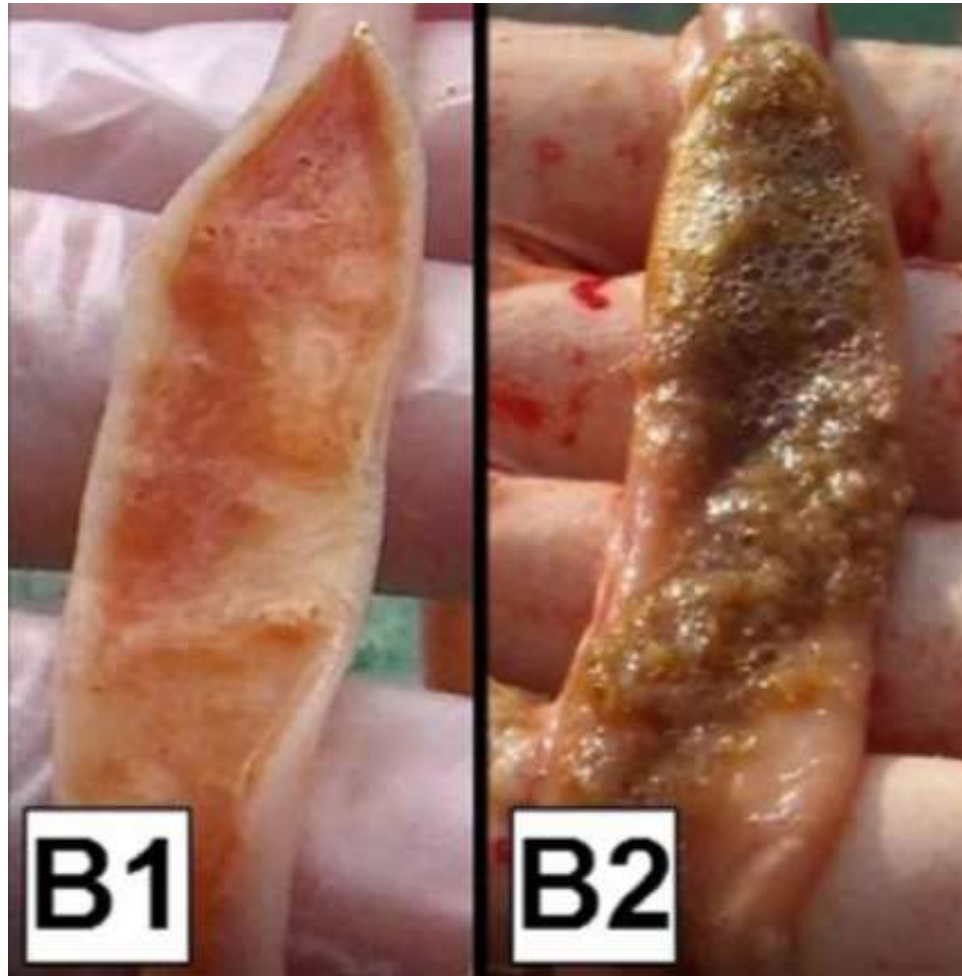
Carotene

Slime

Maldigestion

Malsecretion

Malabsorbtion



Teirlynck *et al.* 2011 AvPath 40:2 pp 139-144.



## Thin gut wall

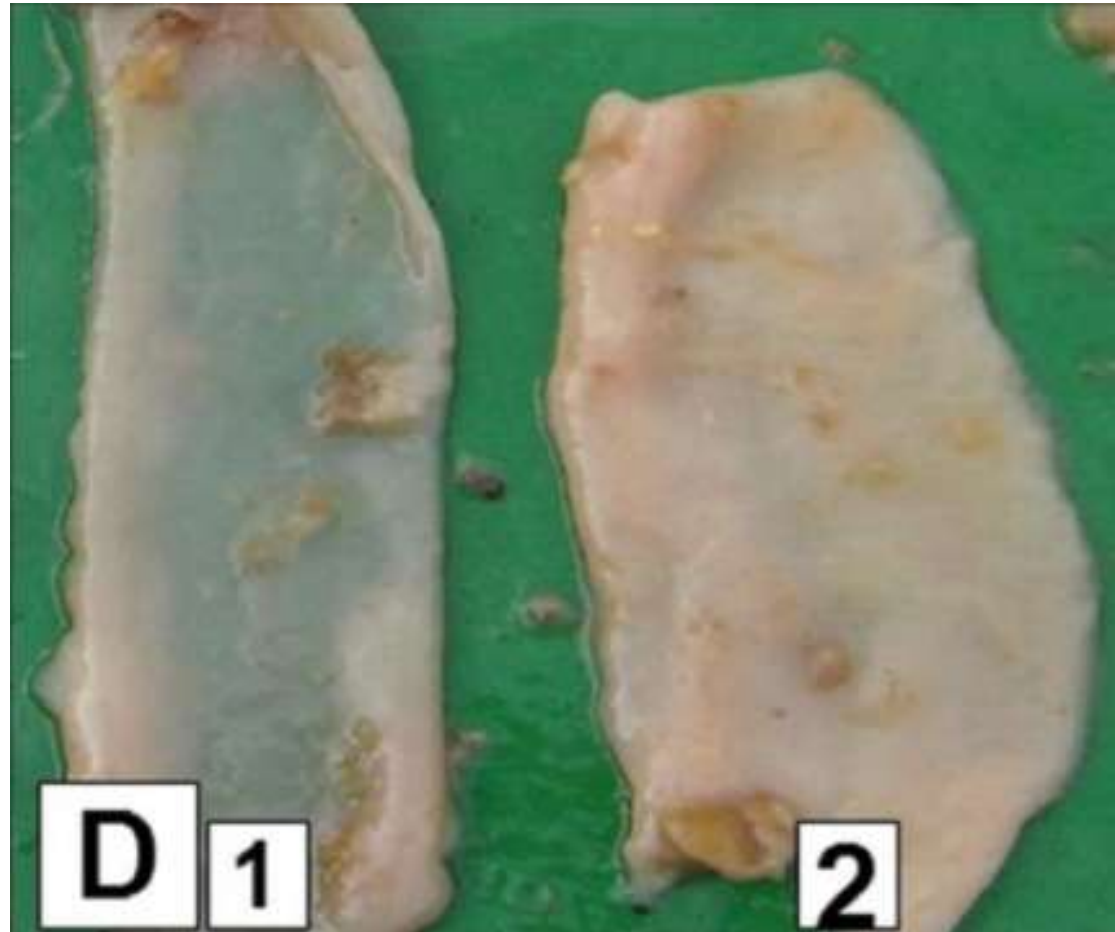


Compromised gut wall  
Compromised muscular layer

Infection

Immune response

Leakage tight-junctions?



Teirlynck *et al.* 2011 AvPath 40:2 pp 139-144.



# Loss of tonus



Loss function tunica muscularis

Leakage tight-junctions?



Teirlynck *et al.* 2011 AvPath 40:2 pp 139-144.



## Undigested particles (colon)

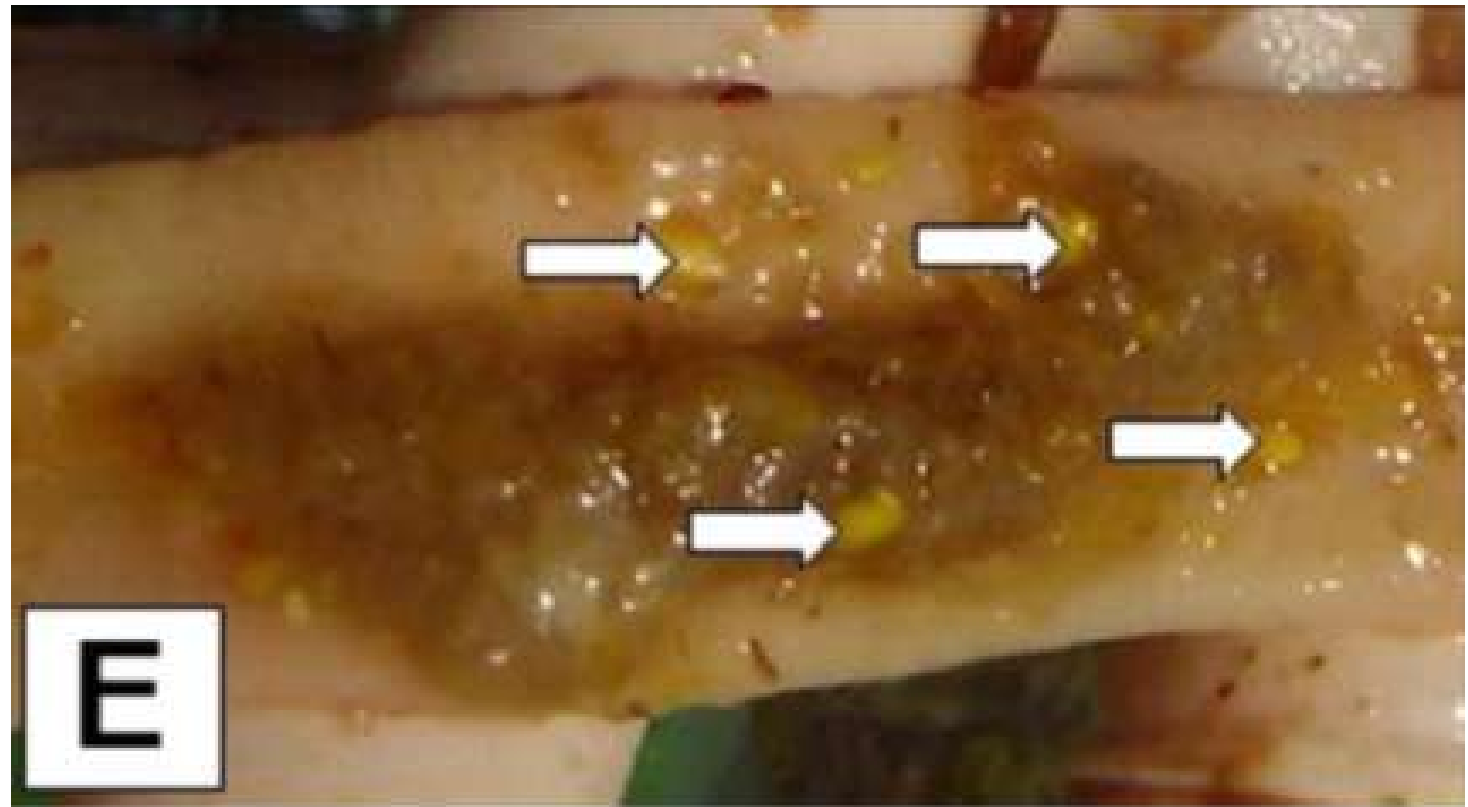


Grain

Roots

Gizzard function

Maldigestion



Teirlynck *et al.* 2011 AvPath 40:2 pp 139-144.



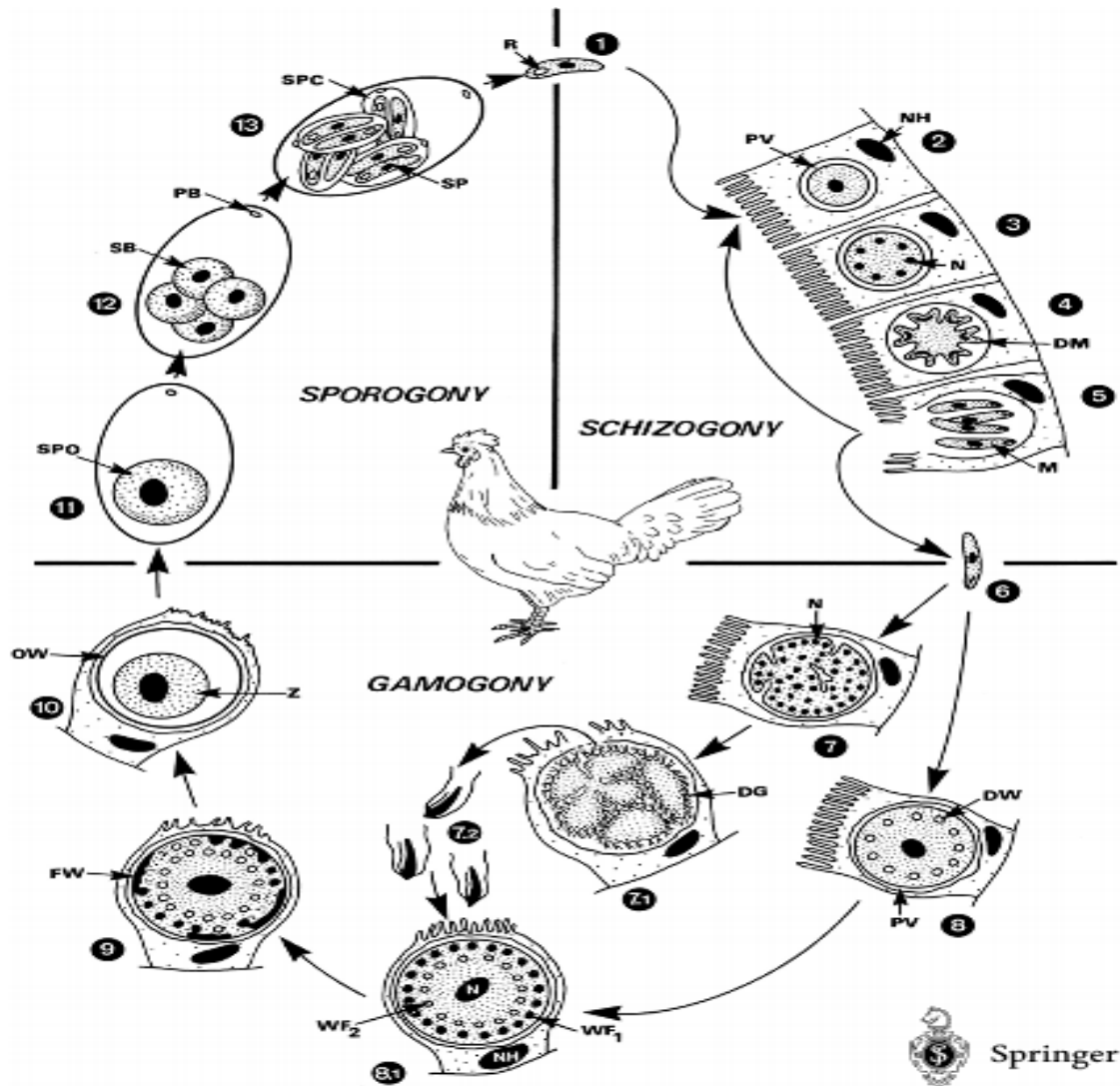
## Inflammation / irritation



Teirlynck *et al.* 2011 AvPath 40:2 pp 139-144.



# Coccidiosis



- Not in DOC, but potentially very early



## ***E. acervulina***



Very high reproductive potential

Duodenum

Epithelium, top of villus

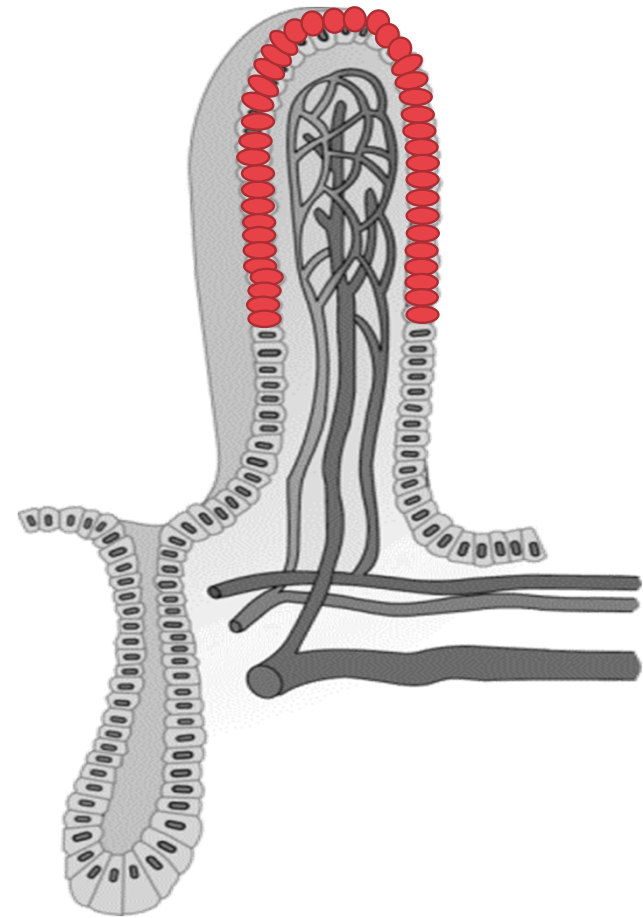
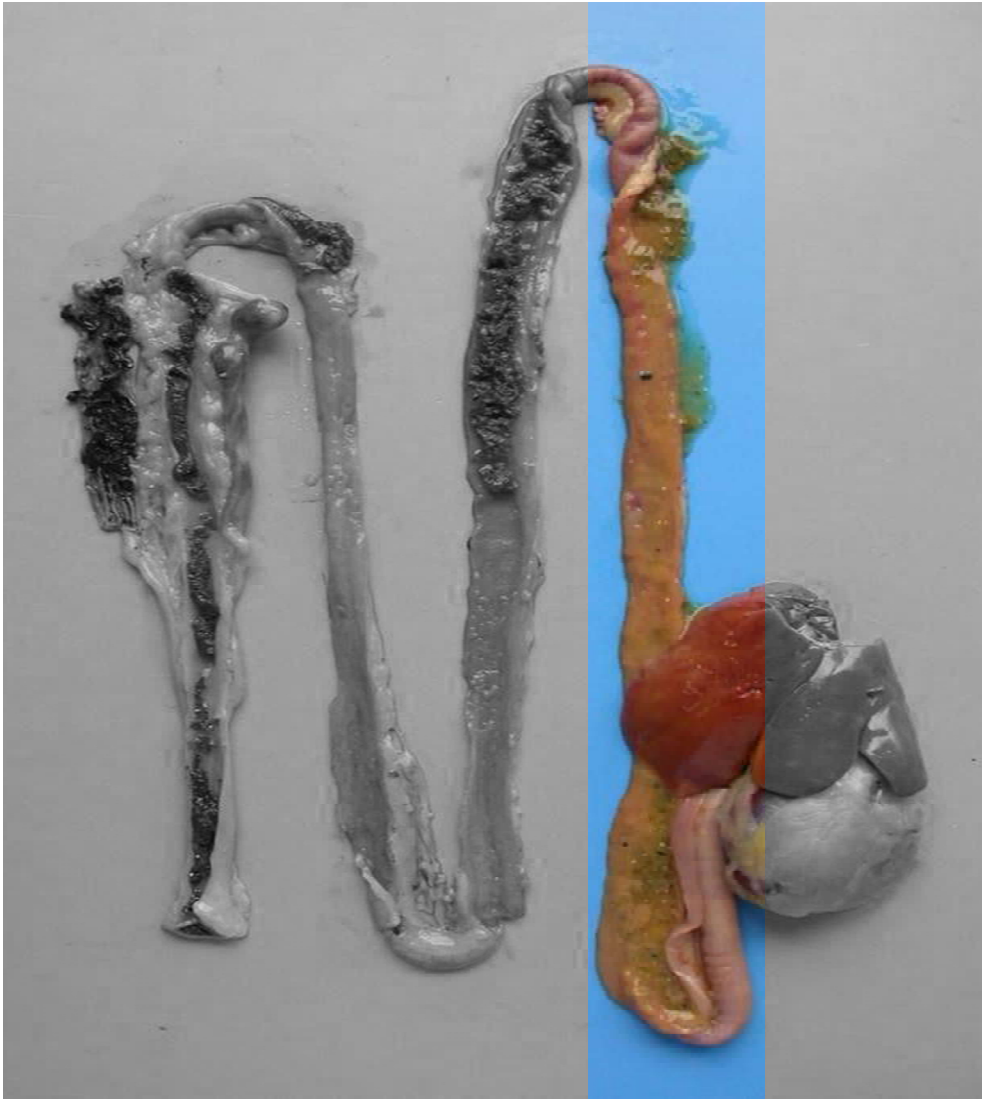
Relatively mild

- Maldigestion
- Malabsorption

White streaks – coalescent white plaque



## *E. acervulina*





## ***E. acervulina* lesions**



D.P. Conway & M.E. McKenzie, 1991. Poultry Coccidiosis



## *E. maxima*



Low reproductive potential

Jejunum

Sub-epithelium, disruption of mucosa

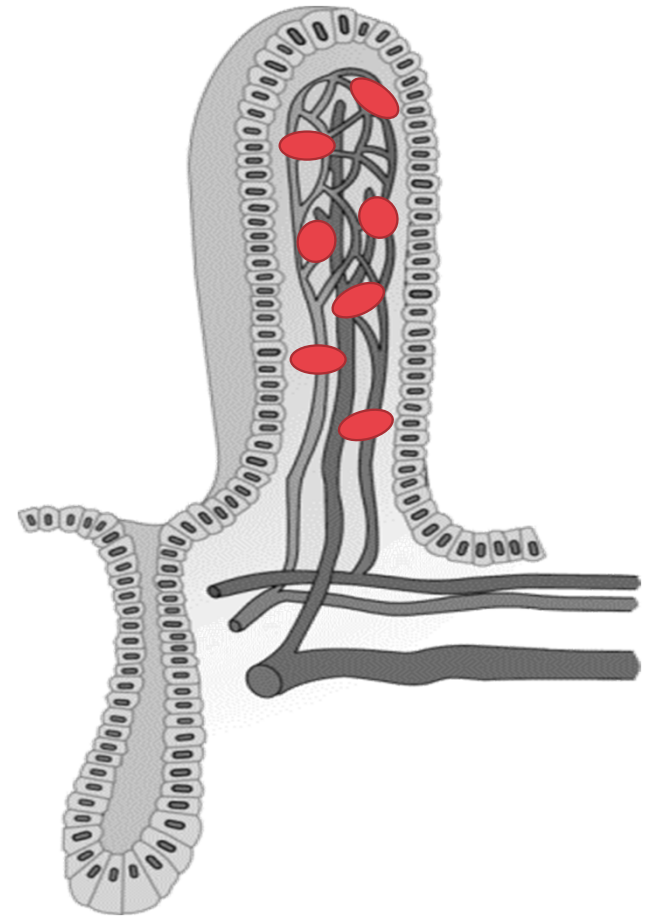
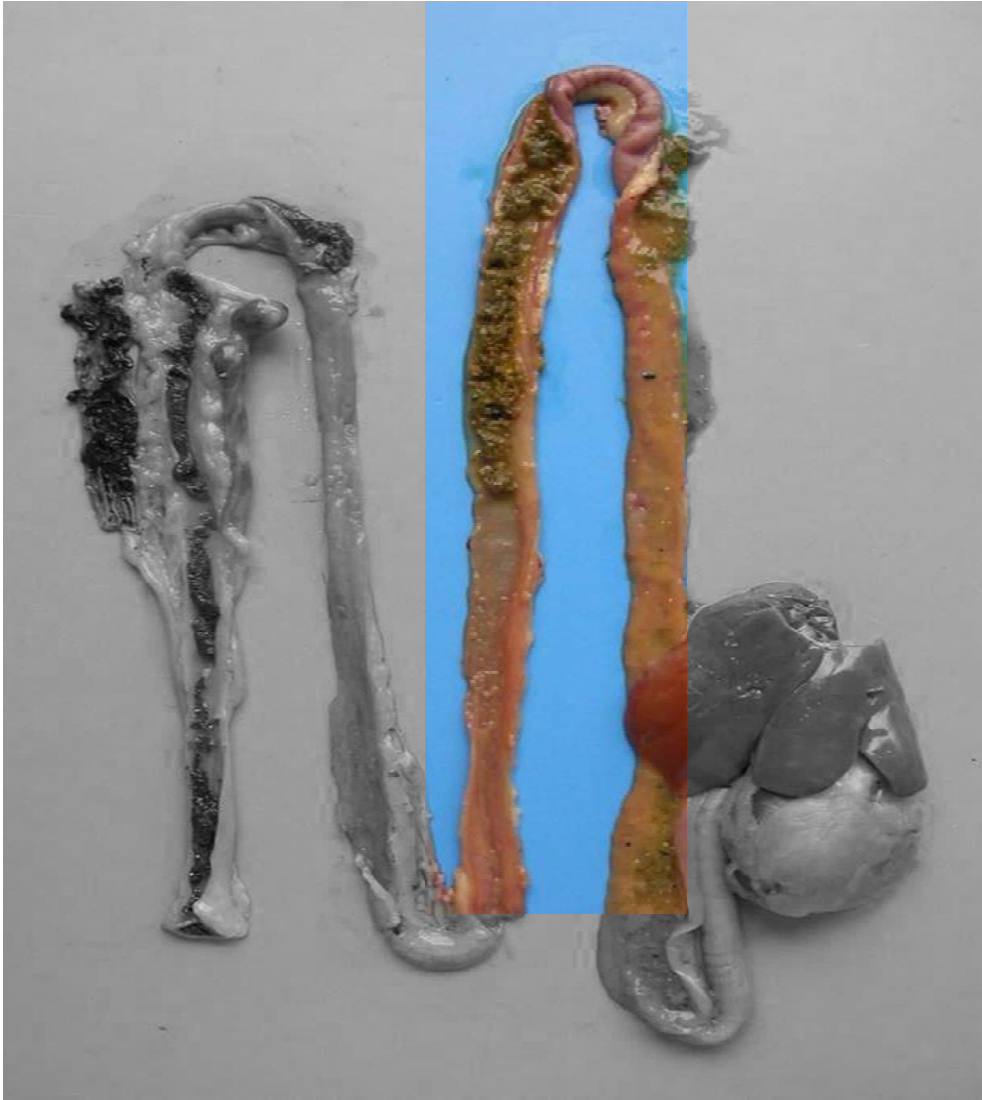
Mild - Severe

- Maldigestion
- Malabsorption
- Haemorrhage

Petechiae – bloody contents



## *E. maxima*





## *E. maxima* lesions



D.P. Conway & M.E. McKenzie, 1991. Poultry Coccidiosis



## ***E. tenella***



Medium reproductive potential

Caeca

Sub-epithelium, destruction of mucosa & muscularis

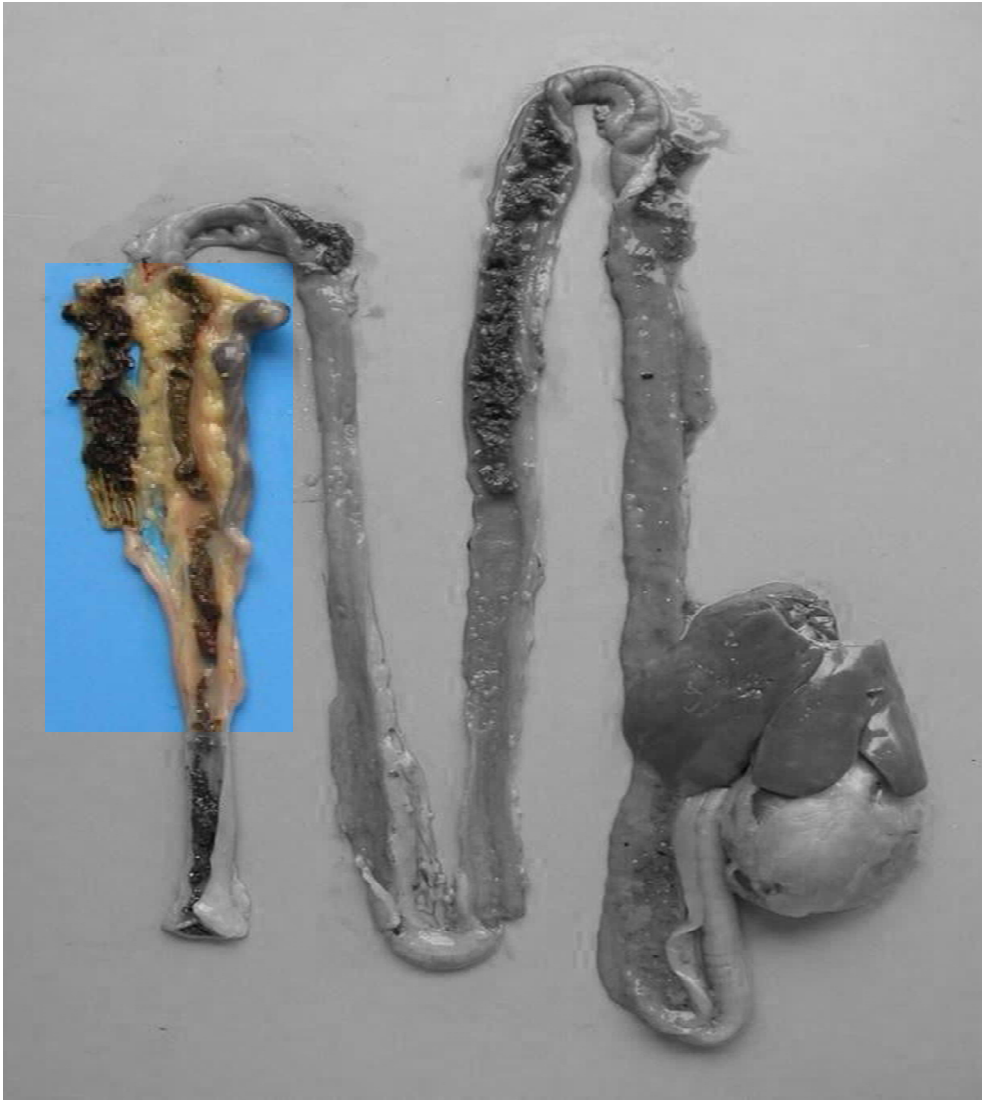
Severe

- Maldigestion
- Malabsorption
- Haemorrhage
- Death

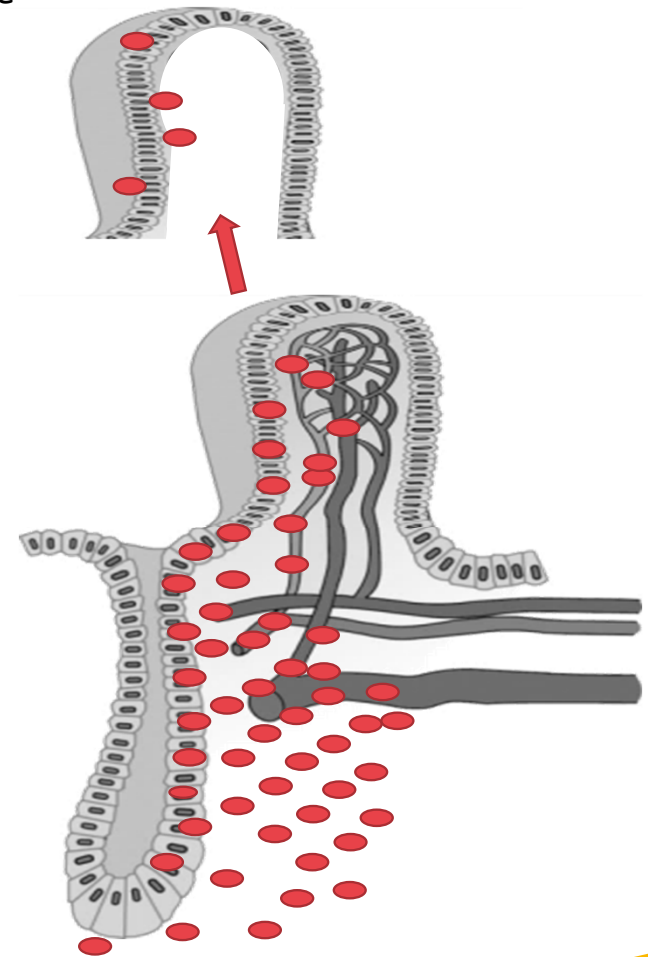
Petechiae – blood filled caecum



# *E. tenella*

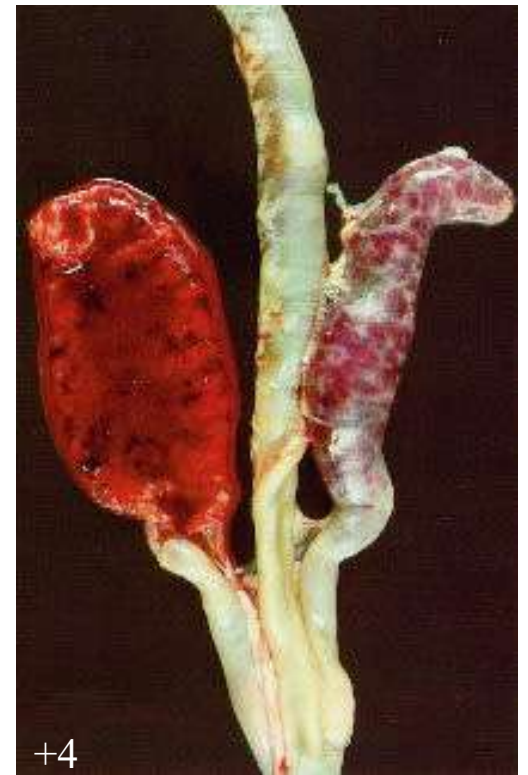


Caseous cecal core  
in 'chronic' stage





# *E. tenella* lesions



D.P. Conway & M.E. McKenzie, 1991. Poultry Coccidiosis



# Thank you for your attention!

Time for a short break





# Poultry Health Seminar, continued

Biosecurity, Vaccination & Importance of monitoring

Robert Jan Molenaar, DVM, FRCPath





# Vaccination

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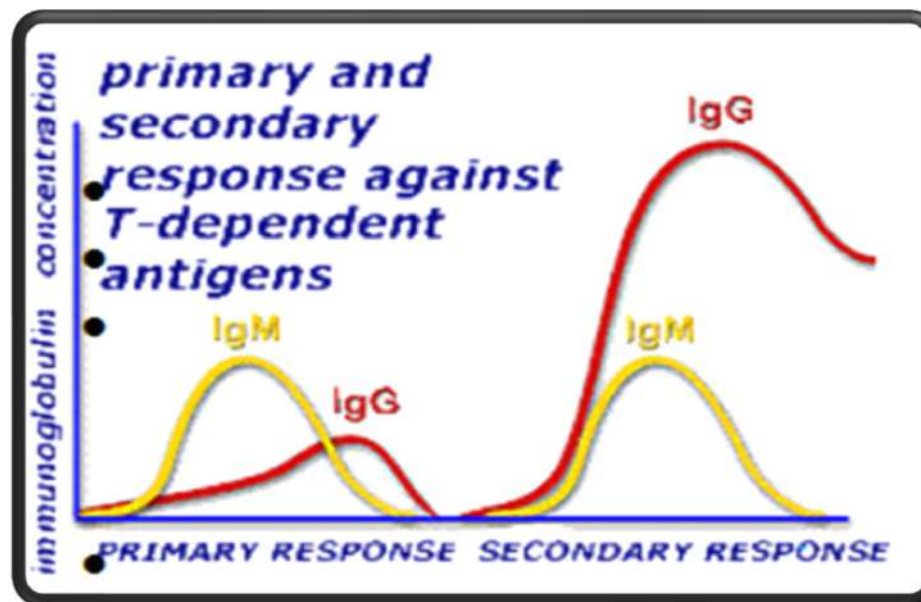




# Aims of vaccination

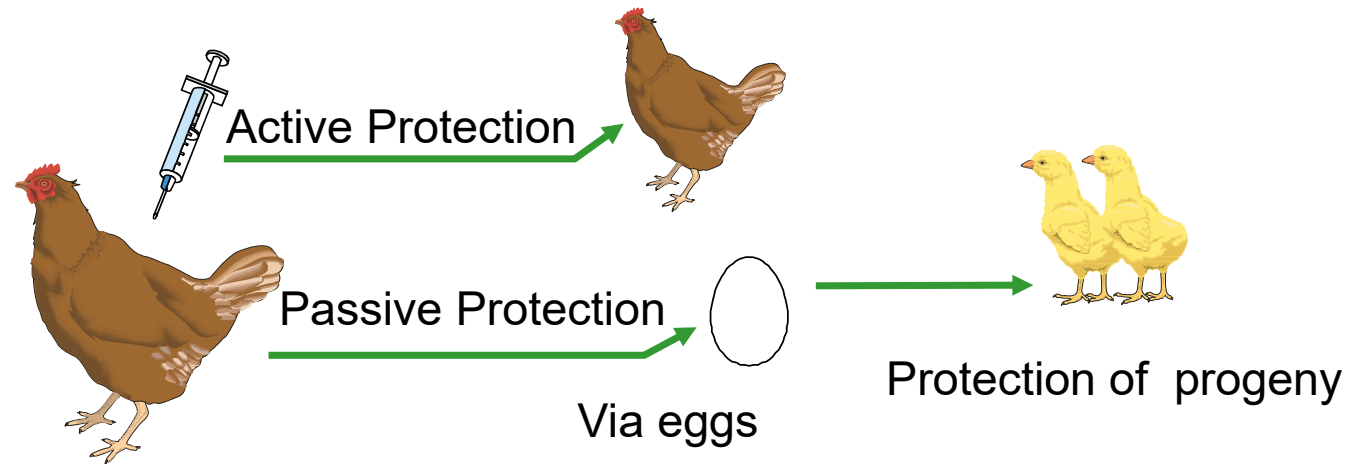


- Formation of memory cells
  - Without the bird getting seriously ill (minimum of harm to the bird)
  - Inducing antibodies so that during a second contact the bird is protected.





# Aims of vaccination





# Live versus inactivated



- **Inactivated**
  - Application by injection
- **Live (attenuated)**
  - Application by coarse spray
  - Application by fine spray
  - Application by eye drop
  - Application by drinking water
  - Application by wing-web
  - Application by injection
- **Which one can cause a vaccine reaction?**





# Live versus inactivated



**All of them!**

A vaccine reaction is required for an immune response





# Inactivated



## **Inactivated vaccines contain formalin or oil to cause tissue irritation**

Contains no live components, no risk of mutation or spreading

Safe and stable for storage

Immune response to certain antigens of the pathogen (only 'exogenic')

Often more expensive

Best after priming with live vaccine

Systemic immunity (humoral response is high)

Less local immunity (cellular response is limited)

High protection after 2-4 weeks

No inactivation by local immunity

A lot of antigen: low risk of neutralisation by Ig

WHOLE-INACTIVATED





# Live vaccines



## **Live (attenuated) vaccines cause tissue damage by replication**

Early protection (1-2 weeks)

Protection does not last very long (depends on disease!)

Replication and infection of host cell simulate original pathogen

Better immune response due to simulation of natural infection

Local and systemic protection

Directed against different parts of the (total) virus: 'endogenic & exogenic antigens'

Mutations to original form might occur

Spreading and mass application possible

Often cheap per dose (compared to inactivated)

**Fragile** to warmth and to detergents

High level of MDA / Antibodies lower humeral response





# Vector vaccines



## **Live (attenuated) vaccines cause tissue damage by replication**

Replication stimulates the immune response of all kind of cells (cytotoxic T cells, all T helper cells, B cells)

Systemic immunity

Local immunity (low, variable)

High protection after 3-5 weeks

Against the inserted gene (protein)

HVT-vector: continuous replication, long lasting protection

MDA has very little influence

Low spreading, individual application required

Sensitive for inactivation (cell bound)

Provides also protection against vector

RECOMBINANT  
VIRAL VECTOR





# Boosting



- Revaccination with live vaccine (first also live):
  - Use secondary response for production of better immunity
  - Reactivate mucosal immunity (IgA)
  - Too soon after first vaccination often not effective as the protection of the previous vaccination can prevent the replication of the vaccine
- Revaccination with inactivated vaccine
  - No interference of the protection



# General information for vaccination



- Use vaccines prior to their expiry date
- Follow vaccine manufacturers' instructions
- Vaccines are very sensitive to incorrect temperatures during delivery, in storage and on transport to farms
- Know what temperatures must be maintained; keep the cold chain.



# Vaccination preparation



- Check vaccines immediately on arrival to ensure correct vaccines have been delivered, that vaccine vials or containers are intact and that the correct temperature conditions exist
- Store live vaccines in a fridge at 4-8C
- Have max-min. thermometers in fridges. Don't open the fridge during power cut!



# Transport of Vaccines to poultry house

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- Take the vaccine out of the fridge just prior to vaccination
- Transport in insulated containers. **Always!**



# Preparation for Vaccination



- Double-check that you have the correct vaccine
- Note the number of doses in the vaccine vial
- Check manufacturer's label advice
- Calculate the number of vials of vaccine required for the house. Overestimate a little.
- Set up
- Maintain vaccine at recommended temperature and other conditions



# Application

- Injection
- **Drinking water**
- **Coarse spray**
- **Fine spray**





**Live vaccination: the gold standard**





# Live Vaccines

- Cold chain!!
- Freeze dried
  - Stored at 4 – 8 °C
  - Out of the cooler: < 2 hours
  - Standard refrigerator



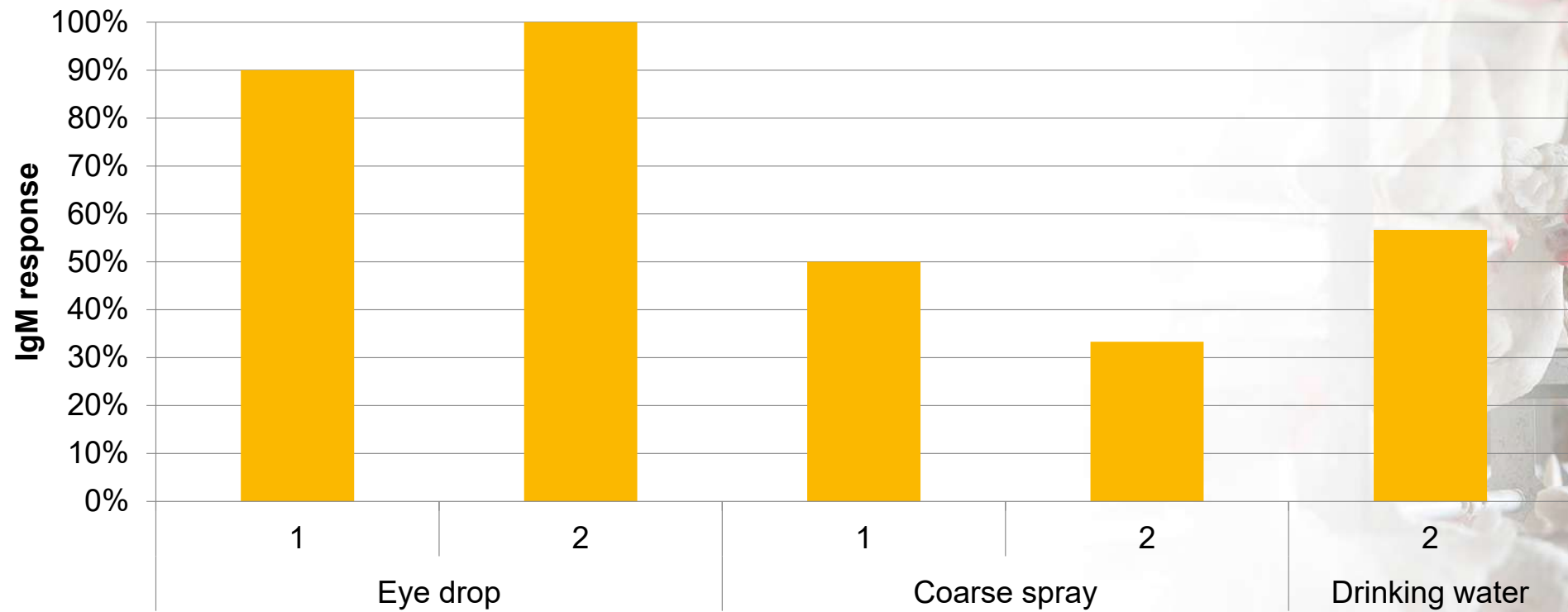
## VETERINARY COLD CHAIN MANUAL

Ensuring effective vaccines





# Application methods



IBV H120 vaccination, IgM response SPF Broilers

Experiment 1: 7 d.p.v. 10 birds

Experiment 2: 10 d.p.v. 30 birds



# Spray vaccination

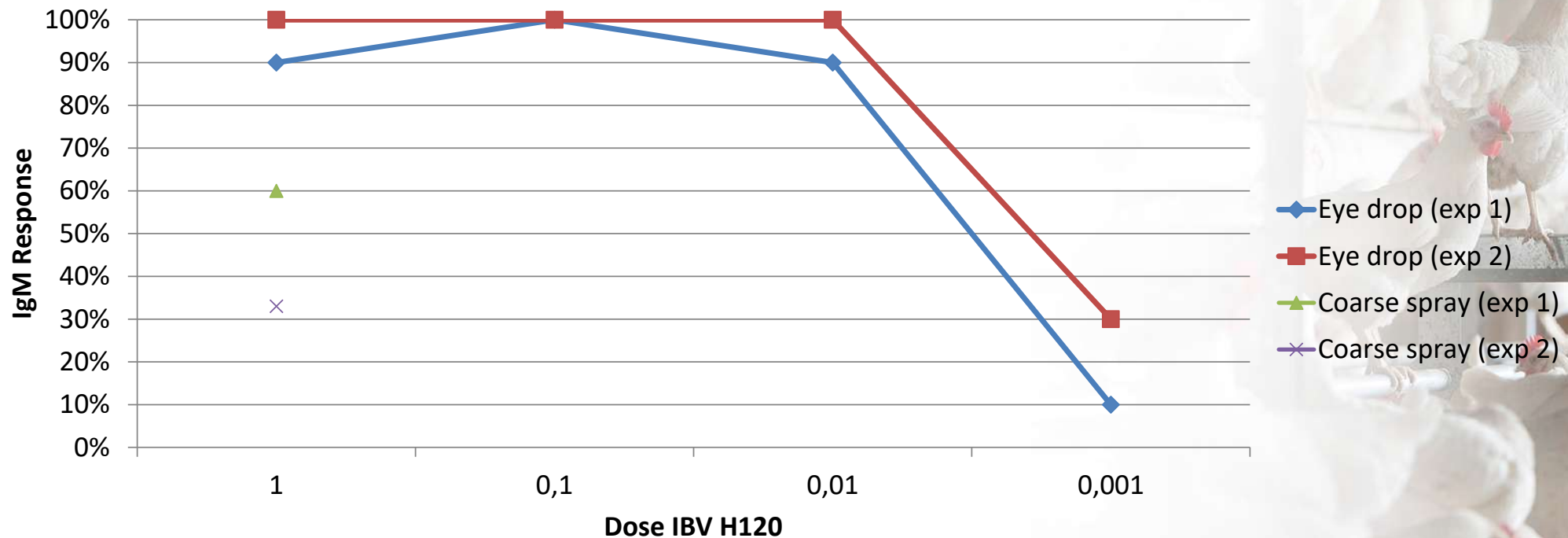


1. Preparation of the vaccine
2. Preparation of the flock
3. Application
4. Check





# Spray vs eye drop

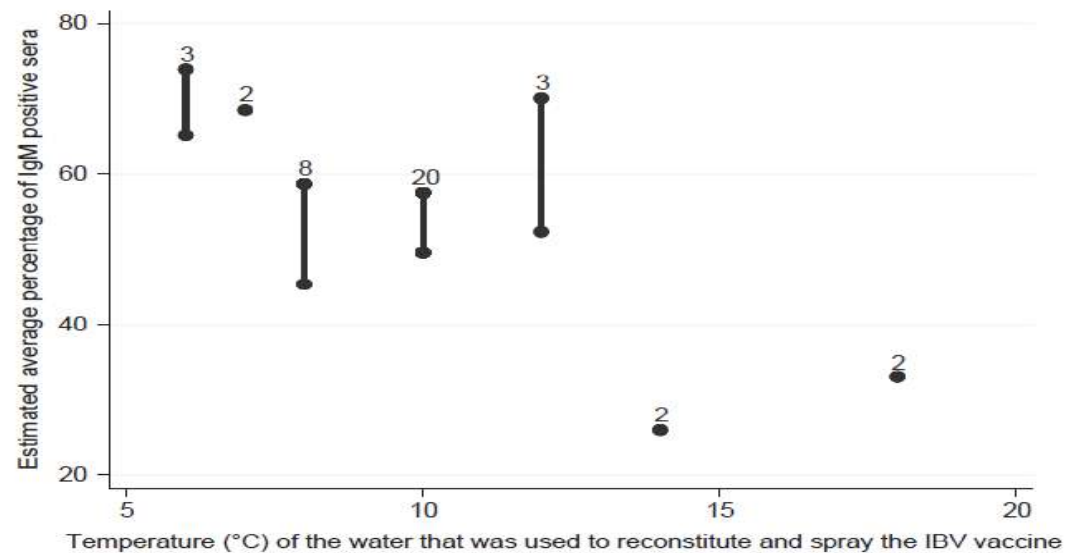




# Water temperature & spray



3.2% improvement per degree Celcius lower



**Figure 6.** Association between the temperature of the water that was used to reconstitute and spray the vaccine and the average IgM response per broiler breeder flock after IBV spray vaccination at approximately 2 weeks of age. Bar: 95% confidence interval of the estimated average percentage of IgM-positive sera for each temperature of the water. Number on top of bar: number of flocks with that temperature of the water that was used to reconstitute and spray the vaccine.

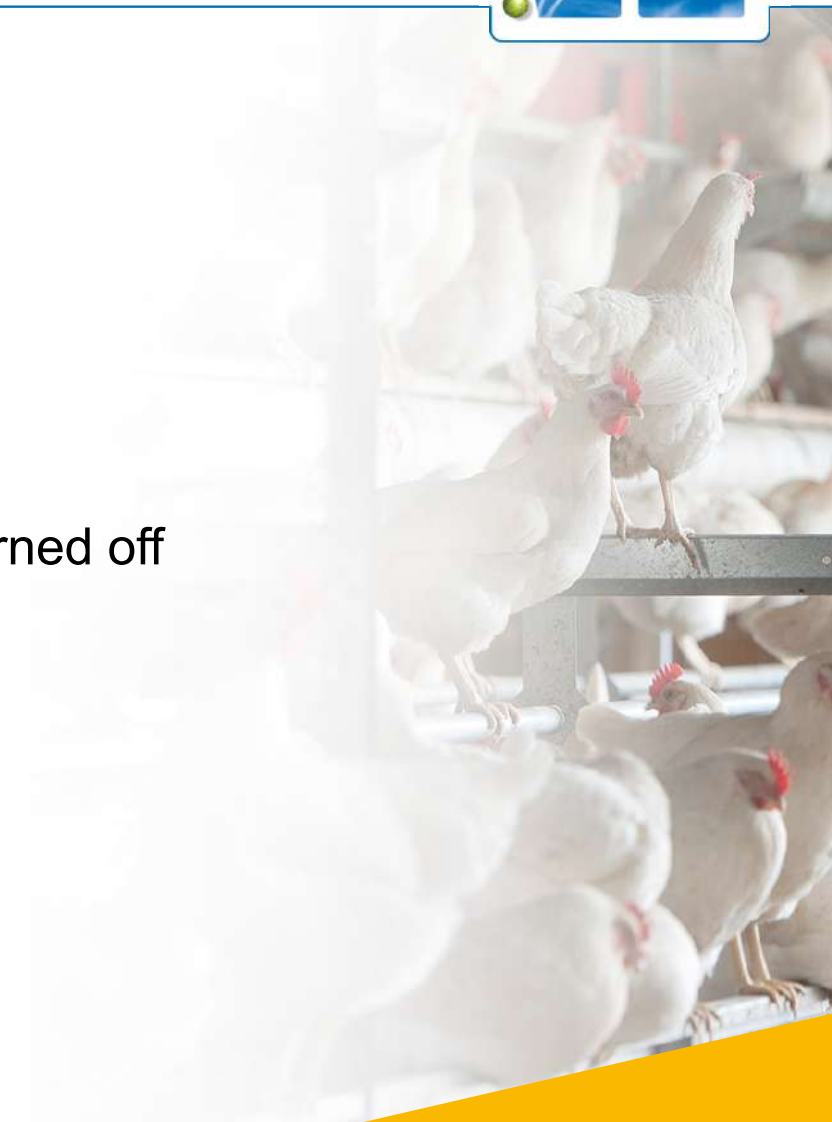




## 2. Preparation of the flock



- Herding / rounding up
- Dimming lights
  - Less activity, eyes still open
  - 41,1% higher IgM response when light turned on
- Preparation vaccine
- Ventilation off
  - 15.5% higher IgM response when ventilation was turned off
- Heater off





### 3. Application of the vaccine



- Coarse spray or aerosol
- Distance to birds
- Walking speed → hit each bird evenly
- Ventilation on





# Application method



## Coarse spray

- Large particles
  - 250 – 350  $\mu\text{m}$
- Short distances
- Contact conjunctiva
- Inhalation
- Ingestion

## Aerosol

- Small particles
  - 20 – 100  $\mu\text{m}$
- Large distances
- Primarily inhalation





## 4. Check



- Manually check whether birds are wet
  - 100 birds per quarter
  - 90% wet
- Serology





# IBV field trial (360 spray vaccinated flocks), practical translation

*De Wit et al, Avian Pathology, 2010, pp 123-132*



- Better results when:
  - Ventilation off during spray (15.5%,  $P=0,037$ )
  - (sufficient) Light on during spray (41%,  $P=0,009$ )
  - Second IBV vaccination not within 2 weeks (2,5% per extra day,  $P=0,005$ )
  - cold water was used (3,2% per °C,  $P=0,021$ )
- Flock size/housing type: unclear
  - Cages significantly lower responses than floor housing (31% vs 53%,  $P=0,01$ )
  - Bigger flocks significantly lower results (1% per 1000 extra birds,  $P=0,04$ )



# Water vaccination

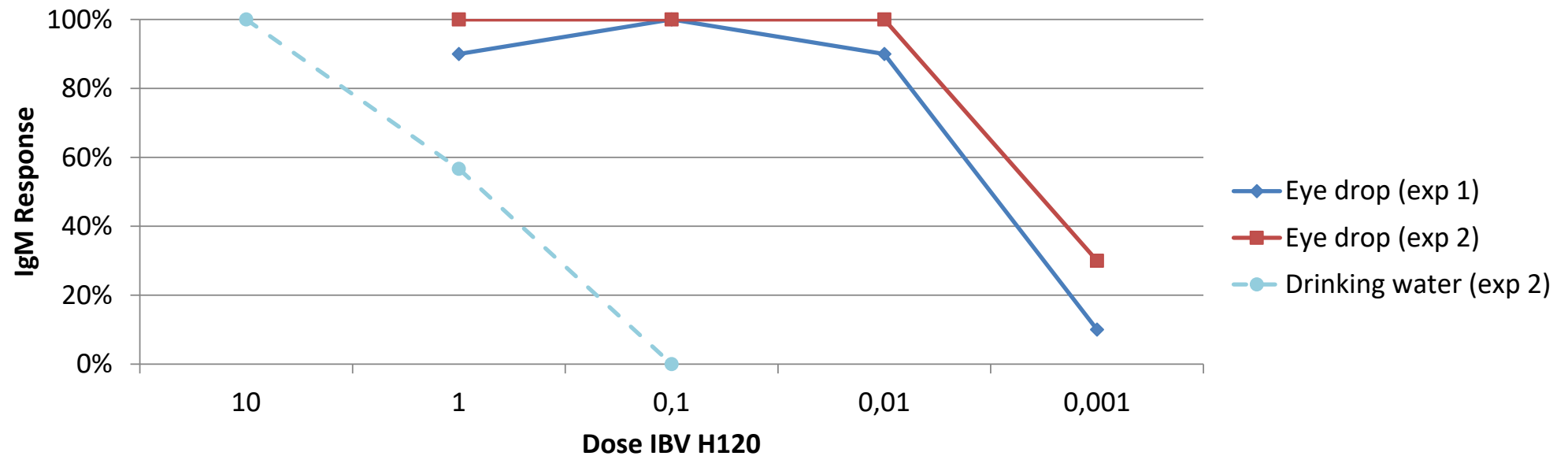


1. Preparation of water lines
2. Preparation of the flock
3. Preparation of the vaccine
4. Supply vaccine
5. Check





# Drinking water vs eye drop





# 1. Prepare water lines



- Amount
  - drinkers (1 for 100)
  - nipples (1 for 10 to 12)
  - cups (1 for 12 to 15)
- Correct height
- Correct pressure (bell 0,4 – 0,8 bar)
- Correct flow (cup; 80-90 ml/min., nipple; 50-60 ml/min.)





# 1. Prepare water lines



- Best to vaccinate in early morning, when temperature is cool
- Stop treatments 24 hours before vaccination
  - Incl. necessary cleaning & disinfection
  - In less intense operated farms: stop treatments / detergents / disinfectants 3 days prior
- Flush
- Clean the bell drinker, medicator bucket and header tank with hot water (no detergent).
- Bleed & retract 1,5 – 2 hours
- Remove filter prior to vaccination
- Prepare vaccine
  - Add stabilizer?
  - Add coloring agent
- Provide in 2 stages of 1 hour each





# 1. Prepare water lines



Provide in 2 stages of 1 hour each

- The titer of reconstituted vaccines generally starts to decline after two hours

Alternative (only if 2x 1hr is not feasible):

- Vaccinate in 2 periods of 2 hours with  $\frac{2}{3}$  and  $\frac{1}{3}$  of the vaccine amount.
- Calculate the amount of water that will be drunk by the birds to be vaccinated using water consumption tables **or prior morning consumption** over 2 x 1 or 2 x 2 hours.
- General rule: age is the total liters of water per 1000 birds.





# water consumption tables



- Tables based on feed intake x 1.85
- Ratio depends on temperature, feed, birds, etc.
- Always check the weight – not the age
- Preferably use REAL data (if available) instead of general tables



Age in days	Weight	Feed intake	Water intake/ day
7	182	33	61
8	212	38	70
9	246	42	78
10	281	47	87
11	320	51	94
12	362	57	105
13	407	61	113
14	455	66	122



Age in days	Weight	Feed intake	Water intake/ day
15	506	73	135
16	561	78	144
17	618	83	154
18	678	89	165
19	741	95	176
20	806	101	187
21	874	107	198
22	944	114	211



## Example flock 6000 birds



- Vaccination at 10 days
- Weight 240 gram
- Waterintake per day: 75 cc
- Waterintake 2 hours:  
$$75 / 24 \times 2 \times 6000 = 37500 \text{ cc} = 37,5 \text{ liter}$$
- Vaccination 2 periods of 2 hours of 35 liter
- Age:  $10 \times 6(000) = 60 \text{ liter} (2 \times 30)$



# Stabilizers



- Stability higher by addition of sterilized defatted or skimmed milk (1:50) or
  - Skimmed milk powder (0.2%) or
  - Coloring stabilizer (AviBlue, High Light or BlueDye)
  - Visibility
- 
- Add with high temperature
  - Stabilizers are no compensation for inadequate water quality control



*Milk proteins in the water bind chlorine and metallic ions, helping the survival of the vaccine virus in the water.*





## 2. Preparation of flock



- Calculate expected water uptake 2 hours
  - Depends on age, breed, feed, temperature, length of water withdrawal
- Withdraw water for 1,5 – 2 hours
  - Synchronized drinking
- Do not adapt lighting scheme





### 3. Preparation of the vaccine



- Tank or dosator?
- Use cold water
- Use gloves
- Take required amount of vaccine out of the coolbox
- Add the stabilizer, wait 15 minutes (the chlorine has to be neutralized)
- Stir well
- Open the vial under water / use tablets
- Stir well
- Dissolved vaccine should be used within 2 hours



When using skimmed powder or skimmed milk:

Add skim milk powder at the rate of 2 grams to each liter of total water or 1 liter of skimmed milk per 50 liters of total water to be used.



- Pour the diluted vaccine into the header tank or a larger bucket only used for vaccination = stock.

Oh and....

Stir well





# Example



- 35 liter of water
  - =  $\frac{3}{4}$  liter skimmed milk
  - = 70 gram skimmed milk powder
- Bucket: 5 liter of water + milk(powder)
- Divide the stock in the 30 liters of water to be used. (30 water + 5 stock)



# Ingredients (source: *Lohmann AH*)





# Protection: add skimmed milk



- Skimmed milk:
  - protein protects the virus.
  - Fat has a negative effect on the virus
- Pure skimmed milk or milkpowder.
  - Take care dissolving (T)







Source: Lohmann AH











## 4. Supply vaccine (pipe lines)



Before preparation of the vaccine:

- Clean the lines by flushing clean water. Collect the water at the end of the line.
- Remove any water filters to the lines





## 4. Supply vaccine (pipe lines)



- Open valve
  - Check water flow + presence vaccine at the end of the line
  - Check flock activity
- Walk through the flock to chase away the birds from the drinker to allow other birds to drink.





- Check that all watering points are working regularly.
- Replace the cleaned filters and turn on the water to the shed immediately after all the water containing vaccine has been drunk. Lines may need to be flushed to remove any air locks or blockages.





## Water vaccination: bell drinkers



- Turn off the main water supply.
- Period of water restriction
- Dim the lights and clean the drinkers. No detergent.
- Prepare the vaccine and mix the stock in the total liters of drinking water.





# Water vaccination: bell drinkers



- Dim the lights
- Bring the vaccine water to birds quickly with a watering can.
- Manpower !
- Increase light intensity and activate feeders.
- Walk around to house to stimulate the birds





## Water vaccination 2: bell drinkers



- Repeat the vaccination procedure with the second batch of the vaccine
- When the water is finished turn on the main water supply.
- Check the water supply for any leakage or blockage.



Also possible: automatic bell drinkers



## 5. Check



- Check color stabilizer uptake
  - Check 100 birds per quarter of the house
  - 90% positive
- Serology





# Problems during vaccination



- Birds are too thirsty
  - Over and under consumption of vaccine
  - Spilling of vaccine
  - Bad uniformity titers: protection level ↓
- Birds are not thirsty
  - Water intake more than 2 hours
  - Under consumption
  - Low titers: protection level ↓





# Alternative Individual Vaccination



Alternative in areas with low labour costs

- Oculo-nasal (eye drop) vaccination
  - Droplet in the eye and on the nostrils
- Oral vaccination
  - Dip the beak in vaccine water



# Environmental temperature



- Correct body temperature: 41,0 – 41,5 °C
  - Set environmental temperature from this
- Cold: huddling, low activity
- Hot: panting, wings wide, low activity
  - Stress on respiratory tract
  - Particles deep in airways
- Temperature stress
  - Reduced immune response





# Hot weather vaccination



- Vaccinate at coldest part of the day?
- Postpone vaccination a few days?
- Add stabilizer?
- Drinking water vaccination:
  - Water restriction: how long? (Dutch circumstances: 2 hours)
  - Per period: No more vaccine water than intake for 2.0 hours.





# Monitoring



- Monitor for diseases on your farm: essential for informed decision on vaccinations / treatments
- Monitor for vaccine-take on your farm: can help to improve vaccination-results
- Next step: sharing findings or centralised monitoring

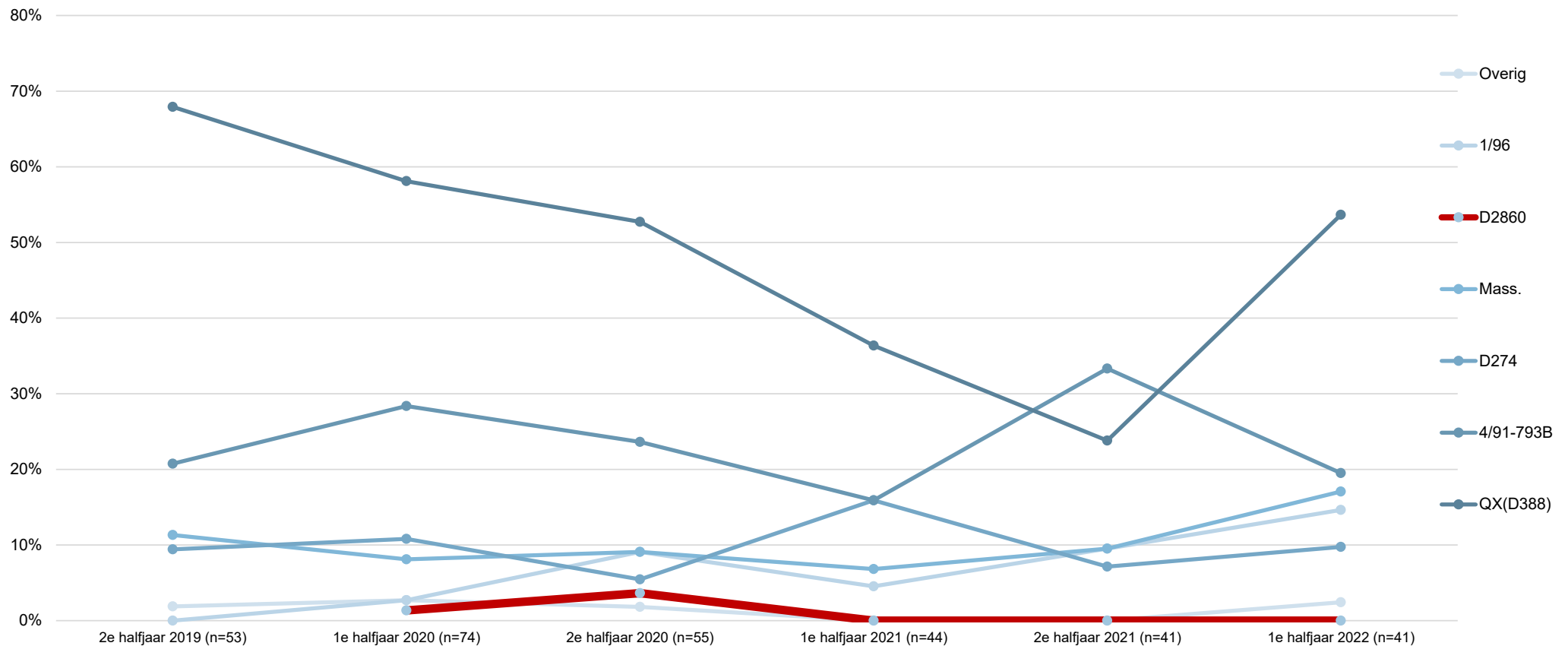
We'll shortly discuss two examples of the added value of a wider monitoring programme



# D2860 & D181 – Dutch monitoring of IBV



Broilers: % IB-types at farm level

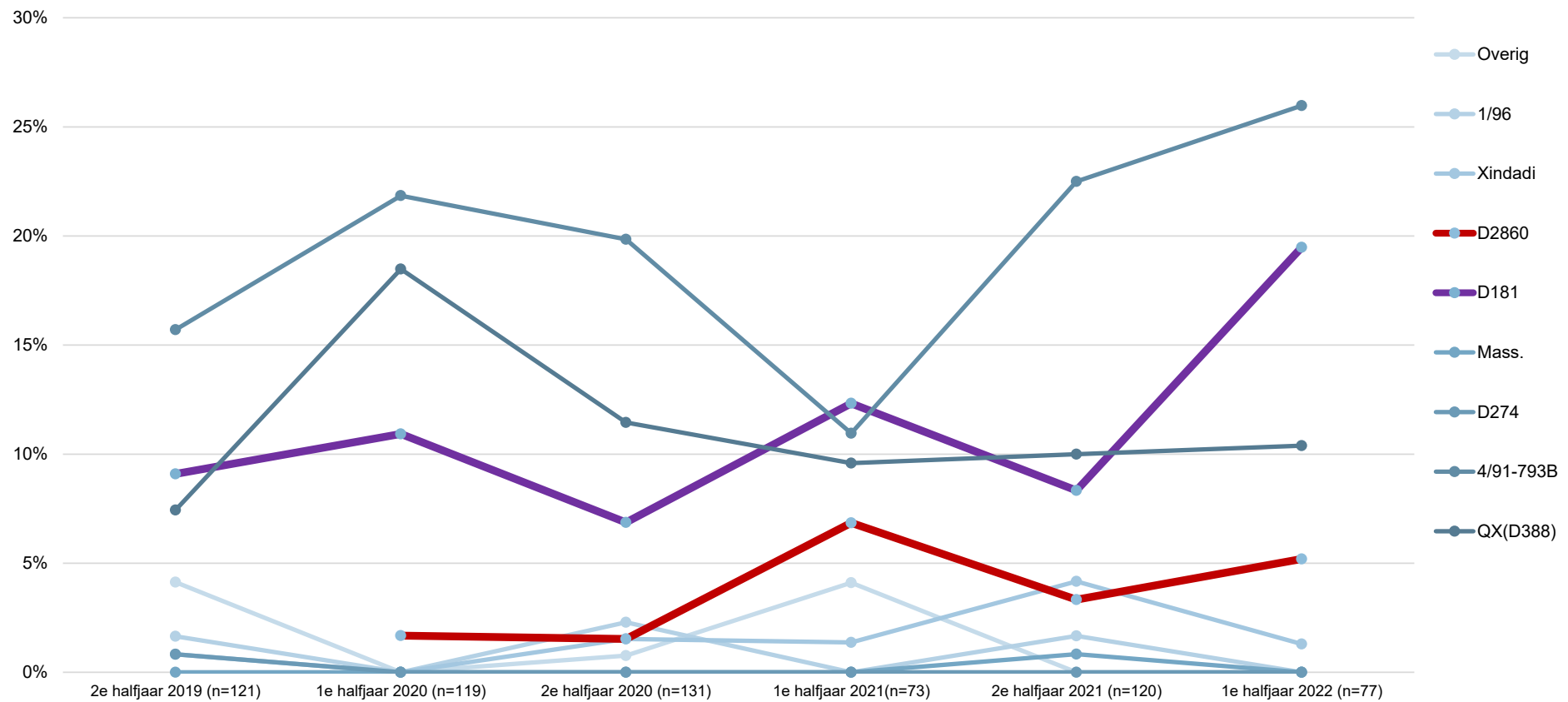




# D2860 & D181 – Dutch monitoring of IBV



Laying hens: % IB types at farm level



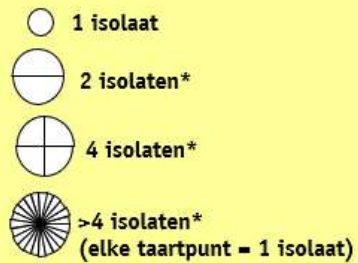


# D2860 and D181 - genetics

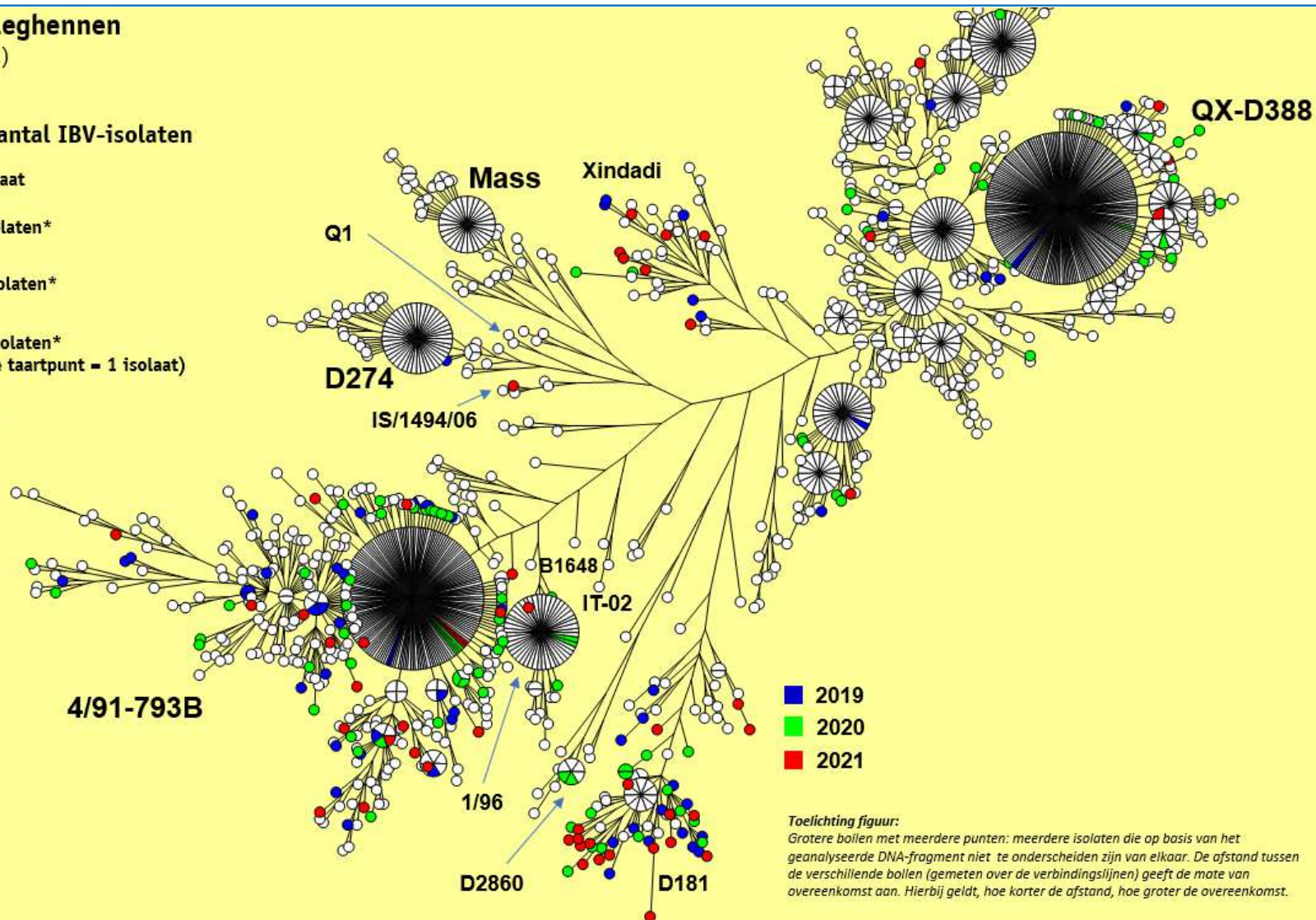


## IBV bij leghennen (2019-2021)

Bollen: aantal IBV-isolaten



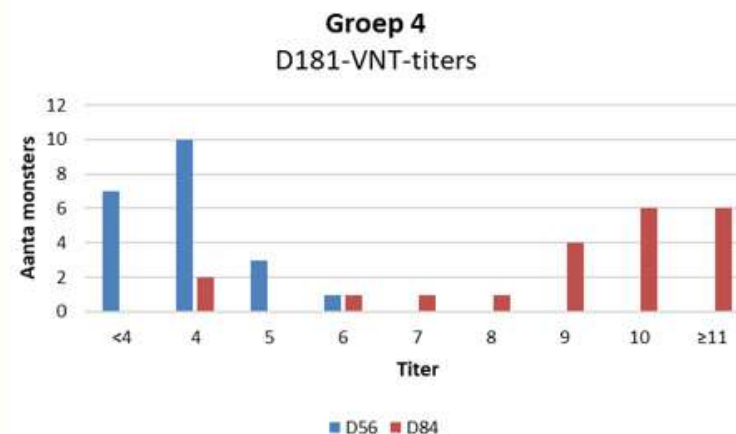
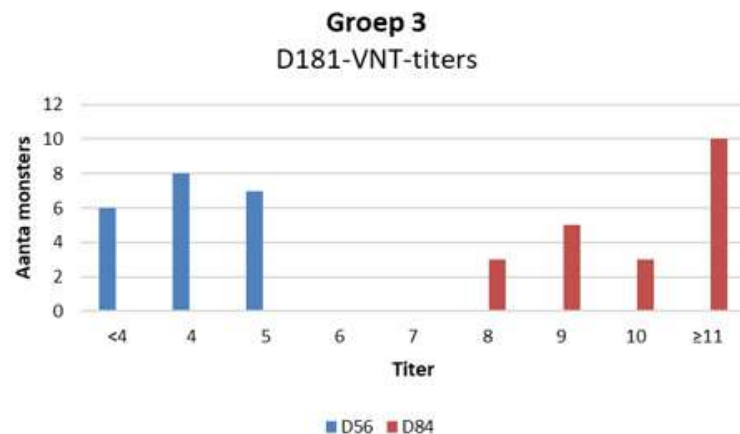
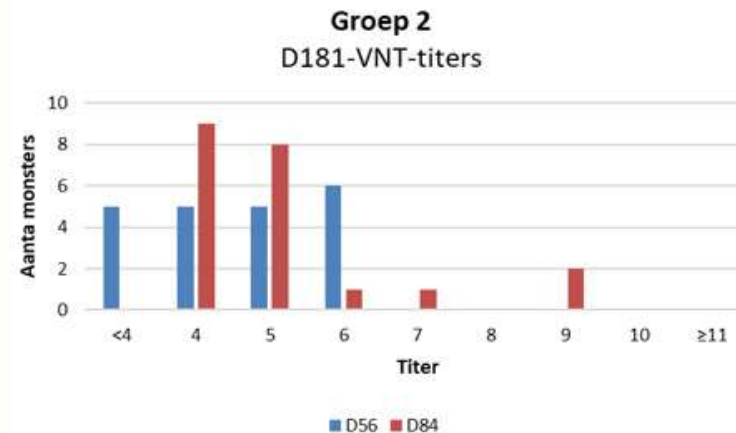
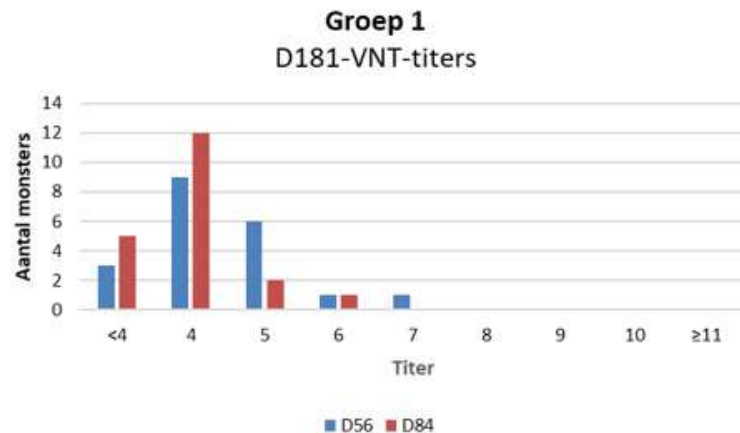
(Bron: GD)



**Toelichting figuur:**  
Grotere bollen met meerdere punten: meerdere isolaten die op basis van het geanalyseerde DNA-fragment niet te onderscheiden zijn van elkaar. De afstand tussen de verschillende bollen (gemeten over de verbindingslijnen) geeft de mate van overeenkomst aan. Hierbij geldt, hoe korter de afstand, hoe groter de overeenkomst.



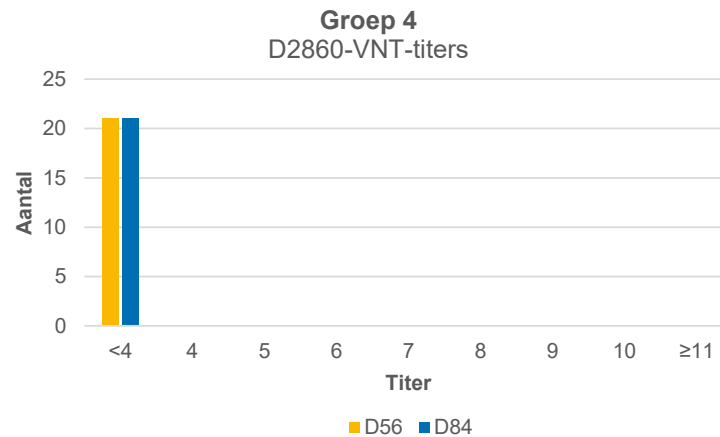
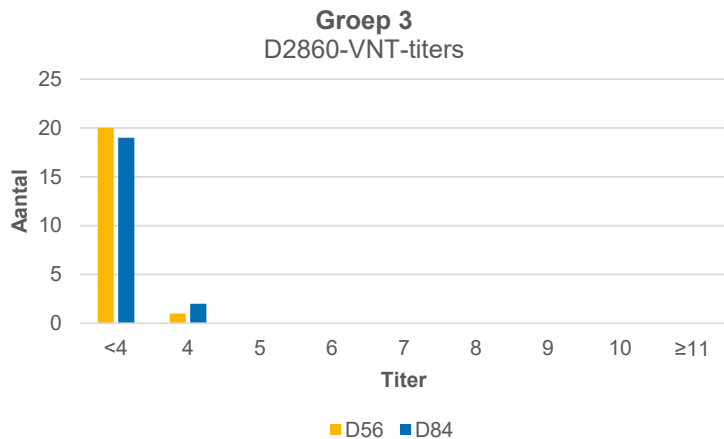
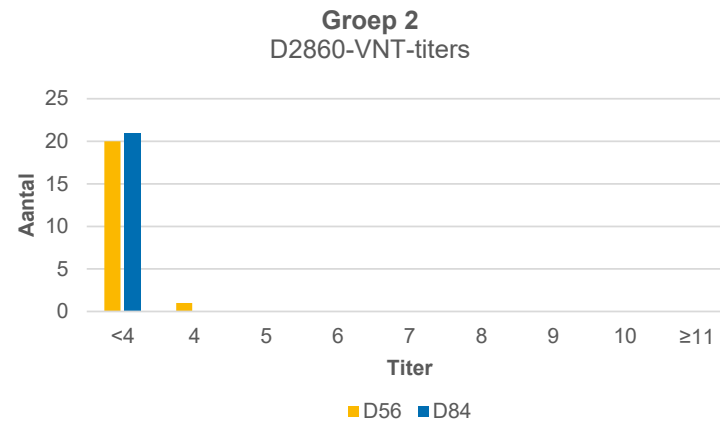
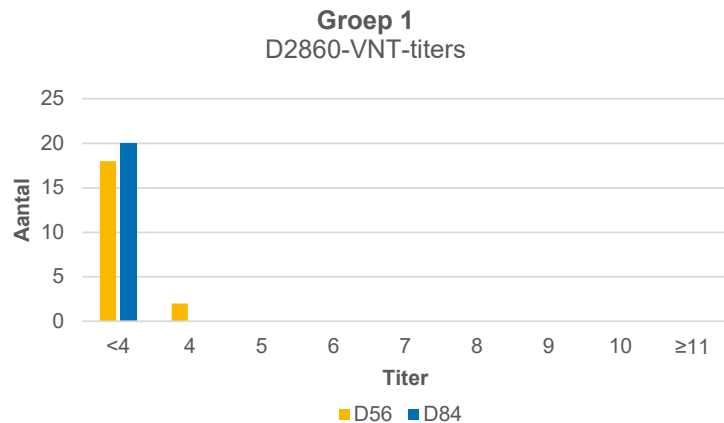
# D2860 and D181 – vaccination?



- All groups:  
D0:  
H120+D274+793B  
D28: QX
- Group 2:  
D56: IB multi
- Group 3:  
D56: OEV-D181
- Group 4:  
D56: IB multi+OEV-D181



# D2860 and D181 – vaccination?



- All groups:  
D0:  
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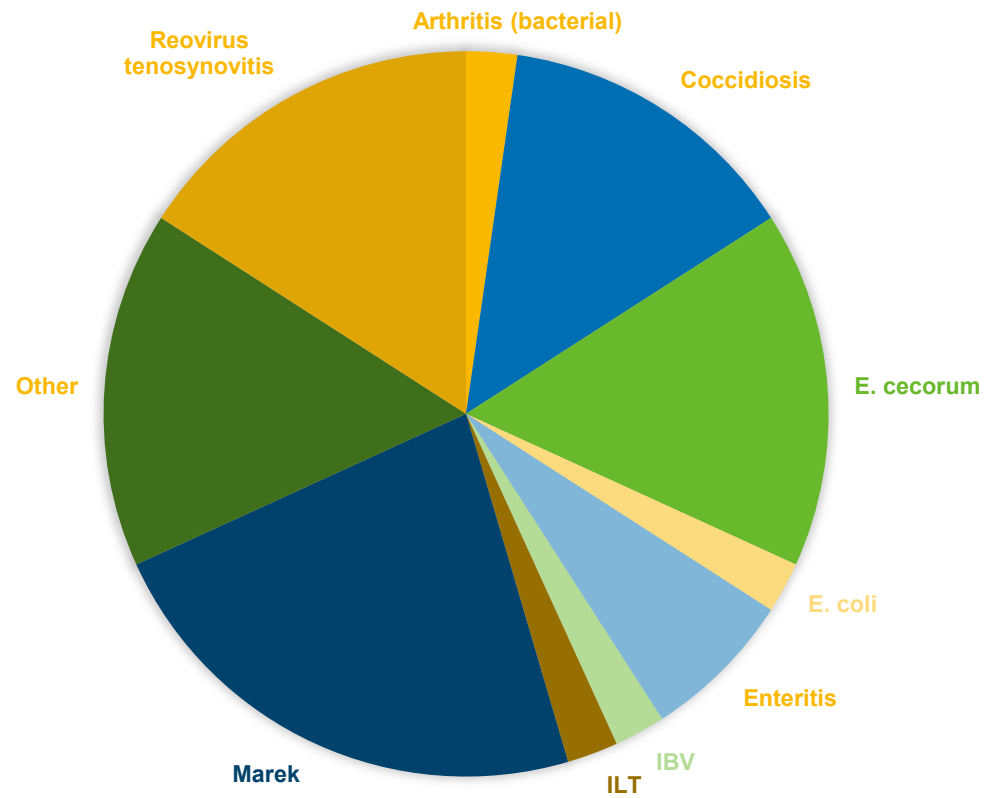
# Example: Marek's disease in the Netherlands



- Problems due to Marek's disease have changed in recent years, with increased problems in slower growing broiler breeds
- Initially the diagnosis was made incorrectly in the field

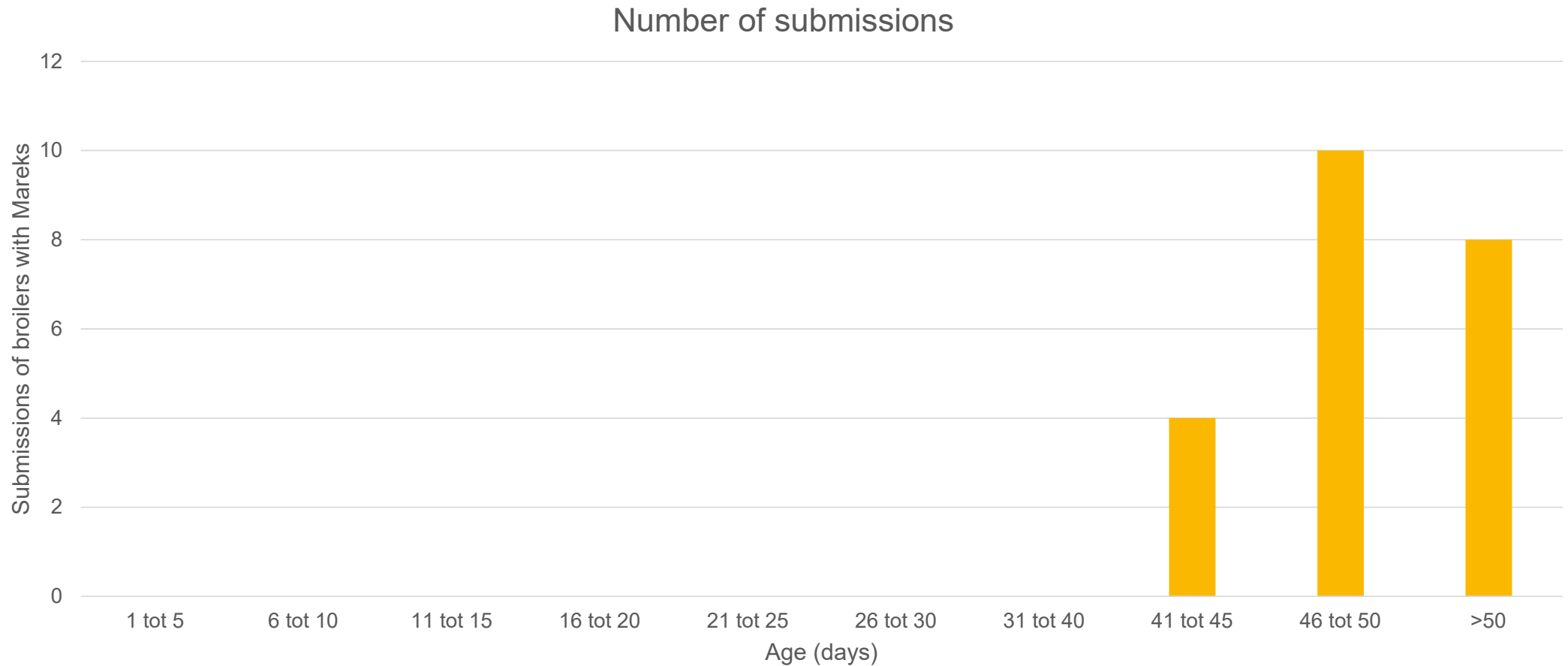


## BROILER OVER 42 DAYS OF AGE



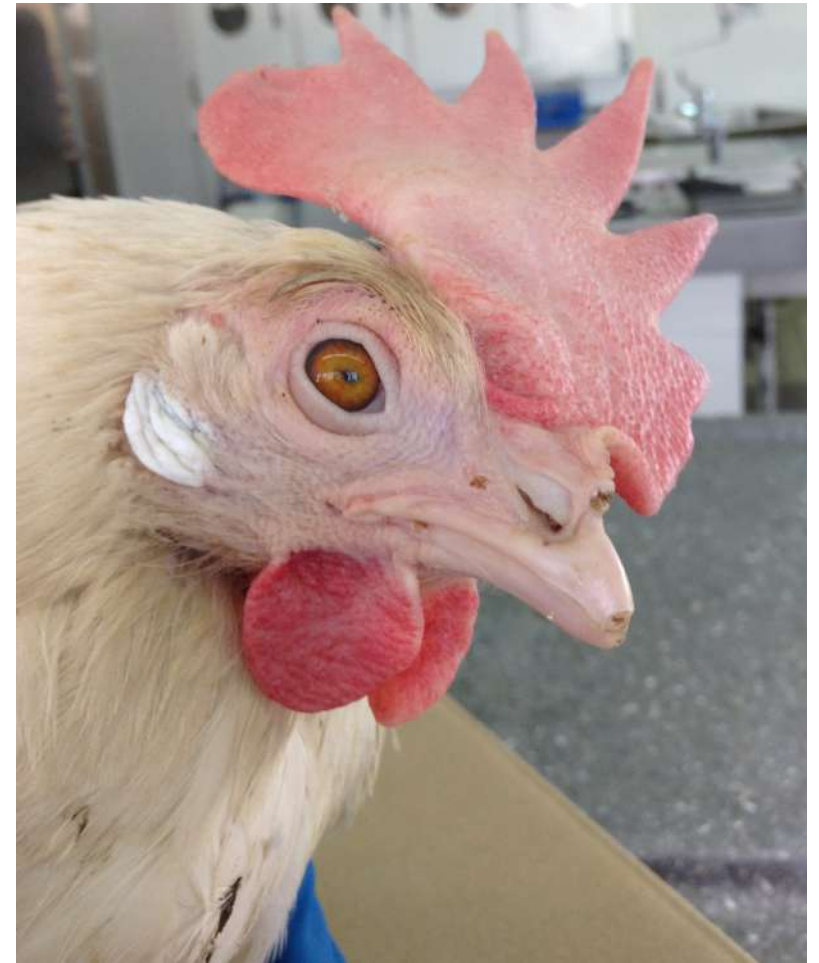


# Age of submissions with Marek





## When I started working at GD....



Een ziekte van leghennen



# When I started working at GD....



Laying hens with tumors



# When I started working at GD....



Laying hens with tumors, sometimes nervous signs

Maternal protection is insufficient

Solution: Vaccinate all newly hatched laying hens at the hatchery







## The classical nervous sign: leg







## In the barn



Watch out! This doesn't have to be Mareks disease!  
(idiopathic polyneuritis, deficiencies, trauma,...)



Nowadays, it often looks different (neck)



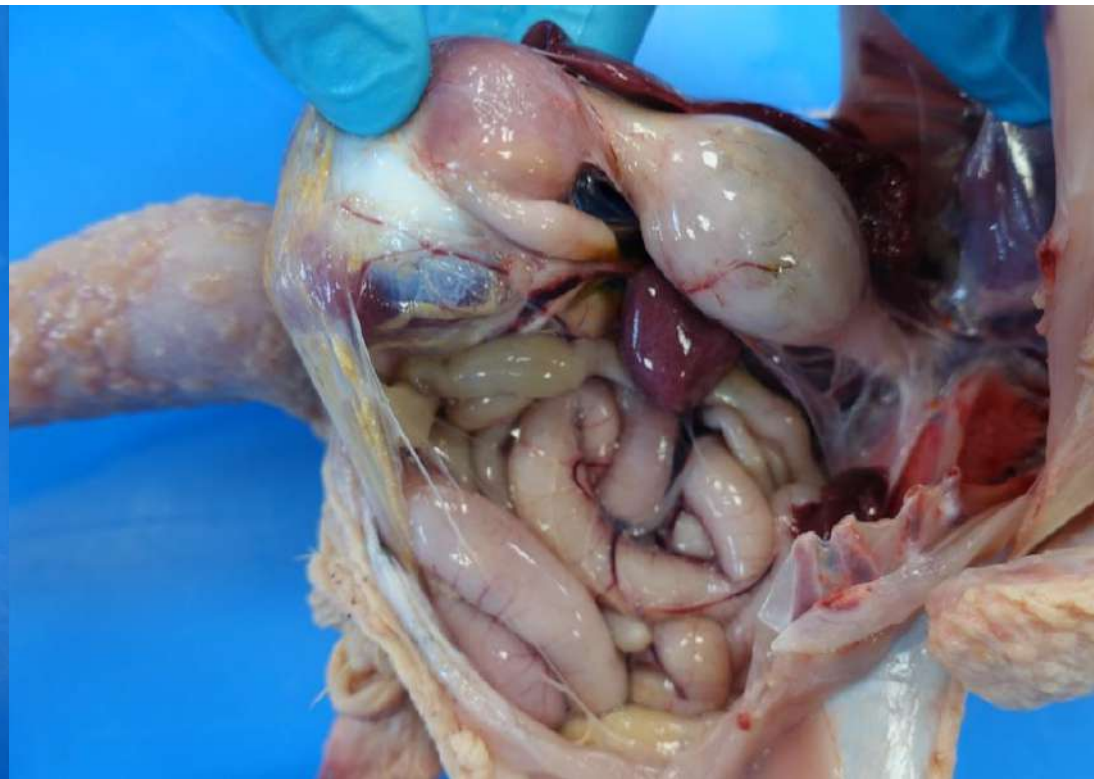


## Originally confused with *E. cecorum* cases



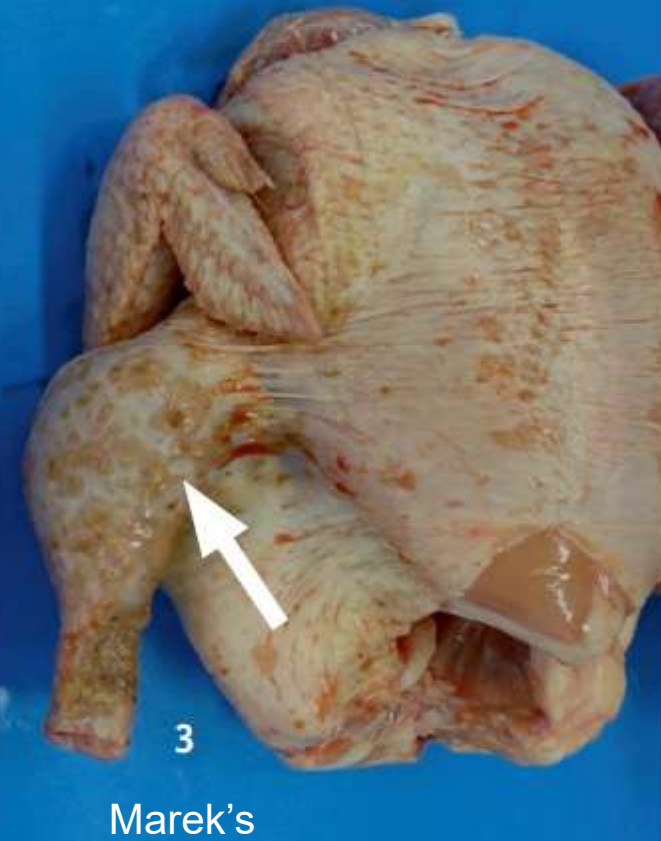


# Mareks during slaughter





# Multiple tumors during slaughter





# Why only in the 'old' broilers?



- About 1 or 2 weeks after infection virus excretion starts
  - Fast growing chicken: late infection / low numbers of infected birds and slow spreading → slaughtered before they have put a lot of virus in the house
  - Slower growing broiler: longer period of excretion → more virus in house → next flock is exposed to more virus → longer and more excretion → next flock even more exposed → ...



Bron: <https://karch10k.wordpress.com/2011/03/30/vicious-circle/>



# Example: Marek's disease in the Netherlands



- Problems due to Marek's disease have changed in recent years, with increased problems in slower growing broiler breeds
- Initially the diagnosis was made incorrectly in the field
- **Monitoring & sharing of monitoring data has allowed to quickly and effectively prevent the disease**



Thank you for your attention!

