CONTROL AND PREVENTION OF IB - BI HETEROTYPIC VACCINATION STRATEGY

IB MAXPRO®

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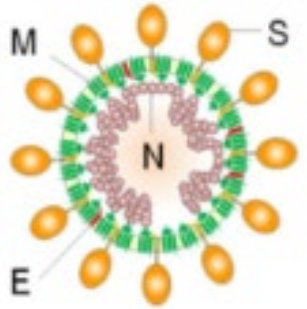
Infectious Bronchitis Virus (IBV)

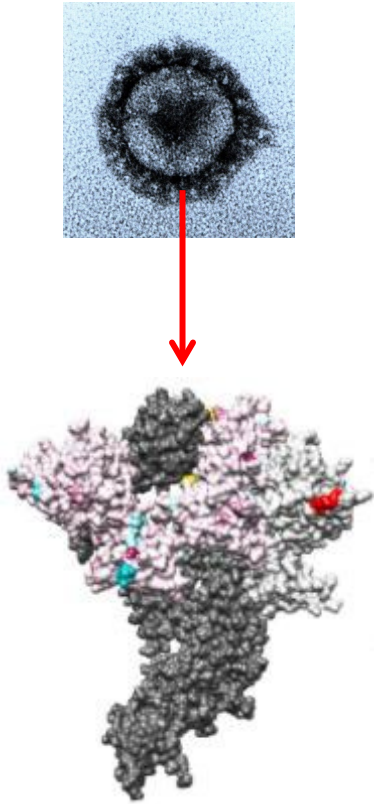
One of the most important poultry pathogens & evolving:

- Highly infectious
- sRNA → Ability to generate new variants:
  - Mutations
  - Recombinations
- Frequent co-infections with different IBV variants and/or other pathogens



IBV SPIKE GLYCOPROTEIN

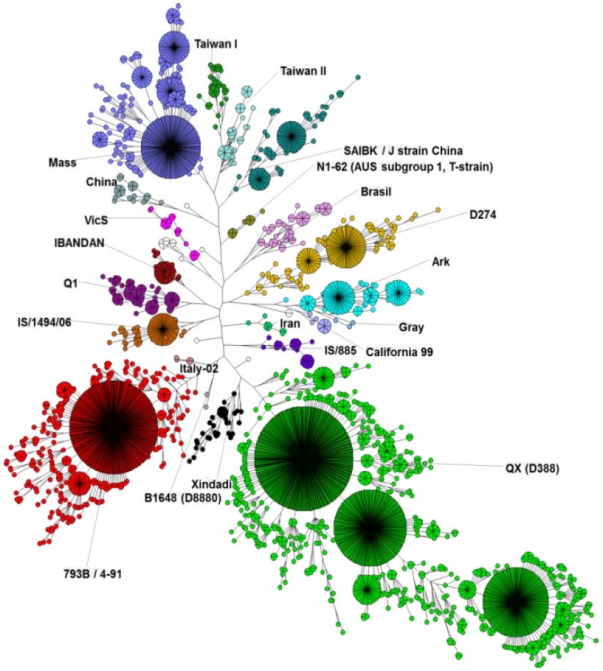
- Comprises the S1 ‘hyper-variable’ regions 1 & 2 (1600 nucleotides)
- It’s a factor of tropism and pathogenicity for IBV
- Attachment and fusion to cell membrane
- Induces protective immunity / Abs
- Determines the genetic / antigenic type:
  - New genotypes / variants have **less than 90% identity** in S1 spike gene with known types



IBV “CLASSIC” & “VARIANTS”

Many serotypes/genotypes/variants:

- “classic” Massachusetts (M41, H120)
- D274, D1466,...
- Ark, Conn, Delaware, Florida, GA98
- 793B (4/91, CR88, 1/96)
- QX (D388)
- Variant 2 (IS/1494/06, EgClevB2,)
- Q1
- Etc., etc.



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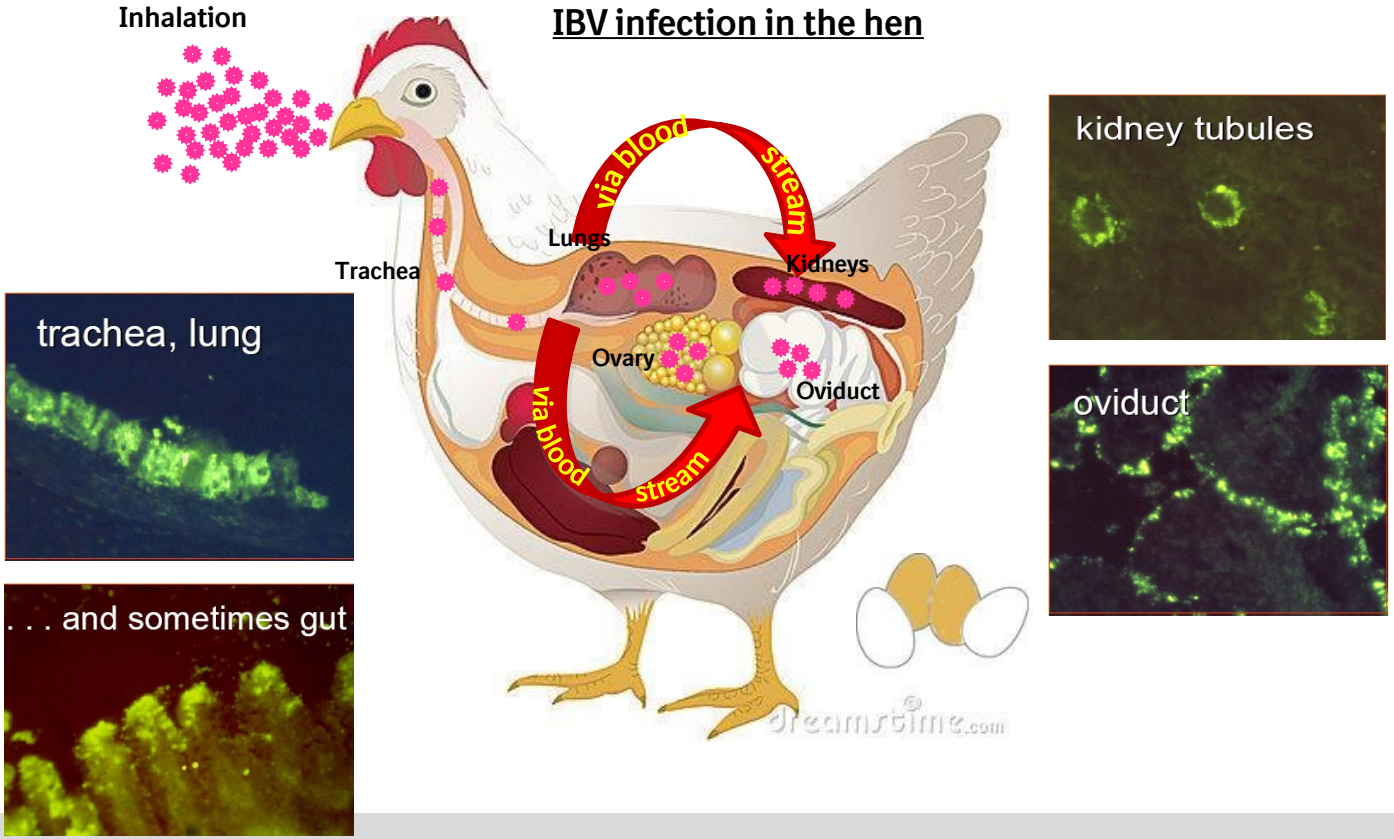
IB viruses detected in Iran

Reported circulation of IBV genotypes related to

- Mass type (GI-1),
- 793/B type (GI-13),
- IS/1494/06 = Variant2 type (GI-23),
- Q1 type (GI-16),
- QX type (GI-19),
- IS/720 type (GI-23),
- D274 type (GI-12; sporadically).

[Jackwood M., 2012, Avian Dis, 56, 634-641; Ghetas A., 2021, Avian Dis. 65:647–651; Ghalyanchilangeroudi A. et al., 2019, C.I.M.I.D. 65, 110–115; Hosseini H. et al., 2015, Avian Dis. 59:431–435, Ghahremani N. et al., 2011, J. Anim. Vet. Advances. 10, 2961-2967]

Infectious Bronchitis Virus



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INFECTIOUS BRONCHITIS VIRUS

Pathogenicity of IB infection / IBV strain tropism

Lesions of the respiratory system:

- Tracheitis, bronchitis, increased mortality by secondary bacterial infections (e.g. E. coli, Mg).

Lesions of kidney:

- Nephritis-nephrosis, urolithiasis.

Lesions of the reproductive system:

- Reduction of egg production / Reduction of egg weight.
- Shell quality (thin shells) / Liquidation of the albumen.
- Mishapened eggs / Reduced hatchability.

➢The lesions of the different organ systems may occur independent of each other.

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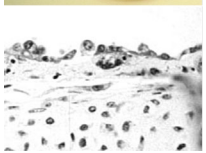
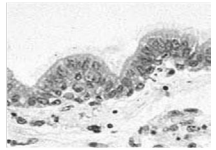
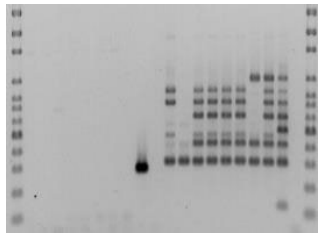
IB DIAGNOSTICS

- Clinical signs and lesions
- Virus isolation in SPF embryonated eggs
- TOC ciliostasis
- Serology: ELISA, HI, VN
- RT-PCR
  - S1 (partial) gene detection
  - Sequencing







IB CONTROL

Measures:

- Biosecurity
- All in - all out policy
- Good hygiene – cleaning & disinfection
- Vaccination

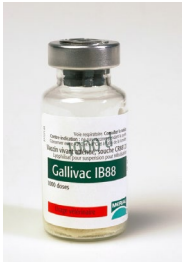
Tools:

- Live and killed vaccines available
- Effective except for variant unrelated strains
- Variable cross-protection (requires challenge tests on TOC or live birds!)

Targets:

- Local immunity:
  - Antibodies on mucous membranes (Conjunctiva, Respiratory tract)
- Cell-mediated immunity:
  - Less specific but broader immunity
- Humoral immunity:
  - Antibodies in the serum

BIAH IB VACCINES

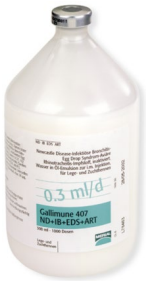


LIVE

- Classic Massachusetts Type: **Bioral H120**
- IB Variant 793/B Type: **Gallivac IB 88**

INACTIVATED

- Classic Mass Type: All IB containing vaccine combinations, e.g. **Gallimune 407, Gallimune 302**
- IB Variant 793/B Type: **COR 2**



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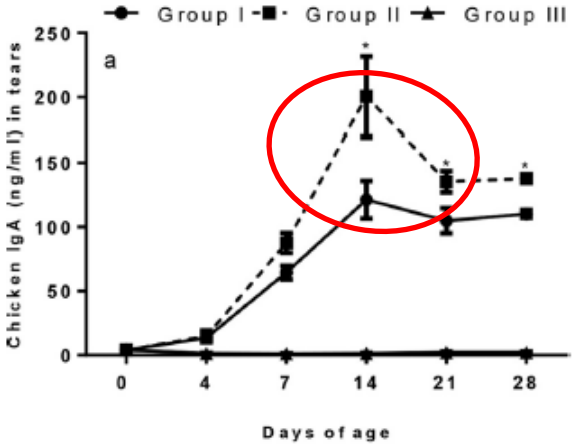
IB - LOCAL IMMUNITY

- Broiler Study at University of Liverpool

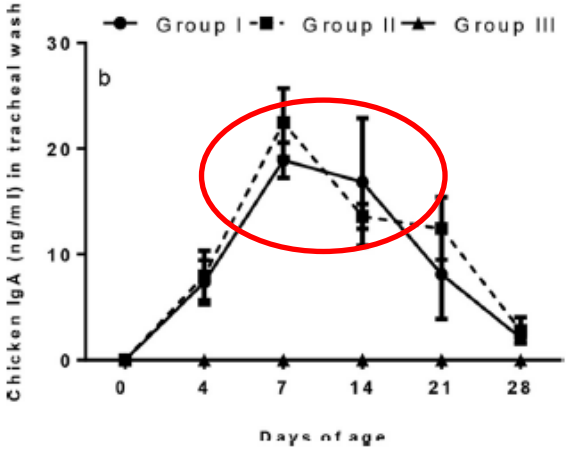
Study design showing groups, vaccine, and vaccination regimes

	Group I		Group II		Group III	
IBV vaccine (dosage/chick in 100 µl)	Day 0	Day 14	Day 0	Day 14	Day 0	Day 14
H120 (3.5 $\log_{10}$ EID_{50})	√		√			
CR88 (4.25 $\log_{10}$ EID_{50})		√	√	√		
Sterile water					√	√

IgA in tears



IgA in tracheal wash



Chhabra R. et al., 2015, Clin. Vac. Immuno., Vol. 22 No. 9

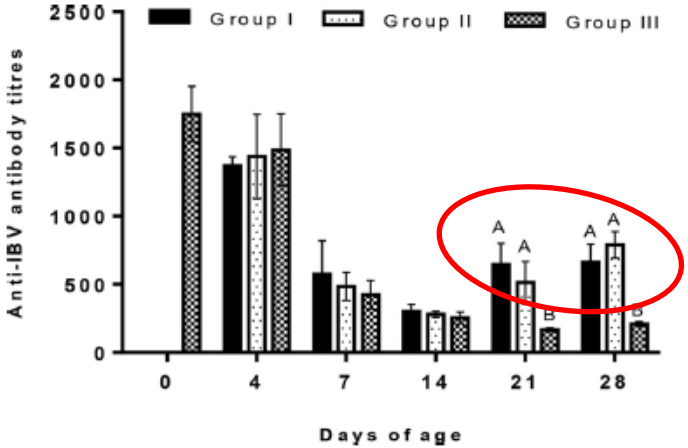
IB - SYSTEMIC IMMUNITY

- Broiler Study at University of Liverpool

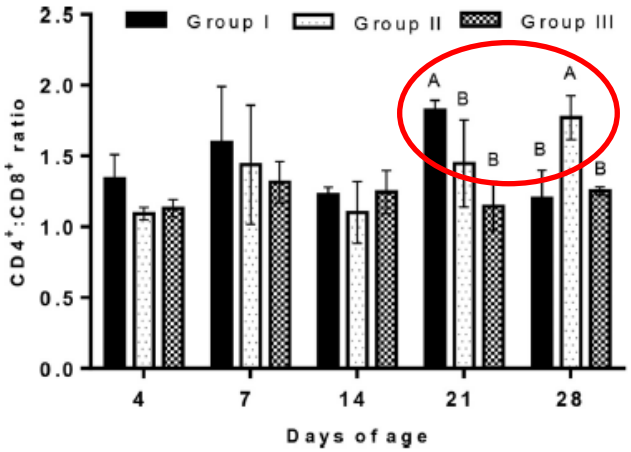
Study design showing groups, vaccine, and vaccination regimes

	Group I		Group II		Group III	
IBV vaccine (dosage/chick in 100 µl)	Day 0	Day 14	Day 0	Day 14	Day 0	Day 14
H120 (3.5 $\log_{10}$ EID_{50})	√		√			
CR88 (4.25 $\log_{10}$ EID_{50})		√	√	√		
Sterile water					√	√

IgG in serum



CD4+, CD8+ Lymphocytes



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CONTROL OF VARIABLE IBV PROBLEMS

IBV CROSS PROTECTION STUDIES

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Virulent IBV cross-protection challenge studies in broiler (University Liverpool)

Vaccination Program & virulent IBV challenge

Day 1: Bioral H120 (& Gallivac IB 88)

Day 14: Gallivac IB88

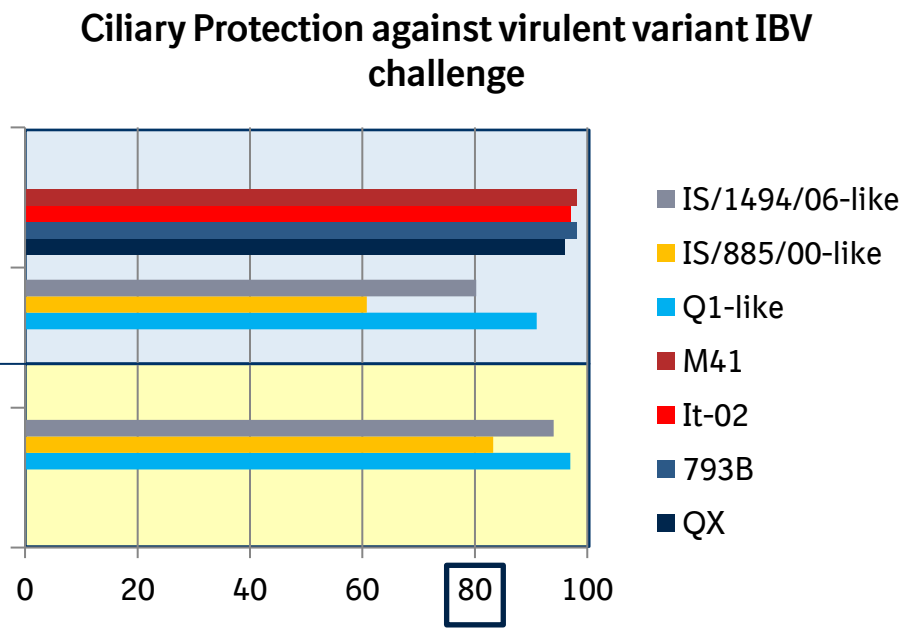
Day 28-30: o/n challenge with M41, 793B, IS/885, IS/1494/06, Q1, QX, IT-02

Examination:
- clinical signs
- ciliary protection
- gross lesions, kidney, trachea
- virus detection by PCR in kidney, trachea
- histopathology in kidney, trachea

Ref.: Awad F. et al, VIII. Int. Symp. Av. Corona- and Pneumovirus and complicating factors, Germany, 2014.

Virulent IBV cross-protection challenge studies in broiler against IBV M41, 793B, QX, IT-02, Q1, IS/885, IS/1494 (University Liverpool)[2]

Groups		
Vaccinations		Challenge
Day 0	Day 14	
H120	CR88	Day 28-30
H120 + CR88	CR88	Day 28-30

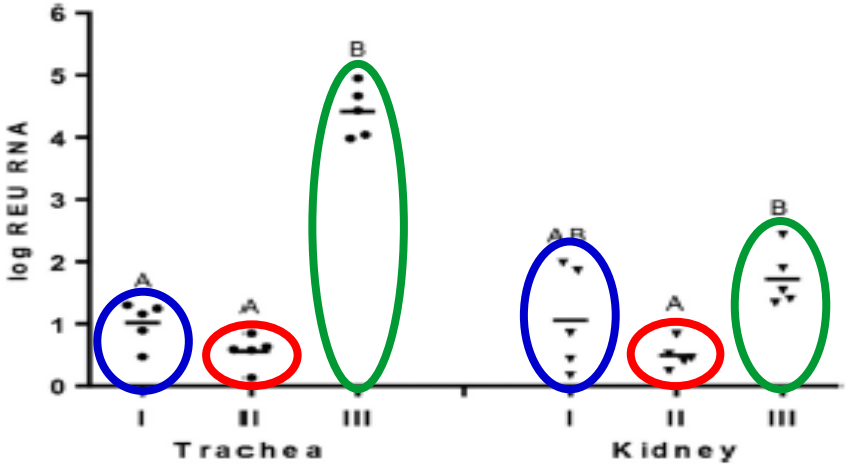


[2] Ref.: Awad F. et al, VIII. Int. Symp. Av. Corona- and Pneumovirus and complicating factors, Germany, 2014.

Virulent IBV cross-protection challenge studies in broiler (University Liverpool)

IBV load in **Trachea** and **Kidneys** 5 dpc

Quantification of virulent IBV Q1 in trachea and kidney measured by real-time RT-PCR after 5 dpc at 28 days



Groups	Vaccinations	
	Day 0	Day 14
I	H120	CR88
II	H120 + CR88	CR88
III	-	-

[Chaabra R. et al.(2015), Clin. and Vacc. Imm. 22, 1050-1059]

Virulent IBV cross-protection challenge studies in broiler against IBV M41, 793B, QX, IT-02, Q1, IS/885, IS/1494 (Univ. Liverpool)

Results

- **Protection against M41, 793B, QX, IT-02 challenge:**
  - **Ciliary protection: 96-98%**
- **Protection against IS/885, IS/1494, Q1 challenge:**
  - **Ciliary protection: 83 – 97%**
- **Gross lesions in kidney or trachea: None**

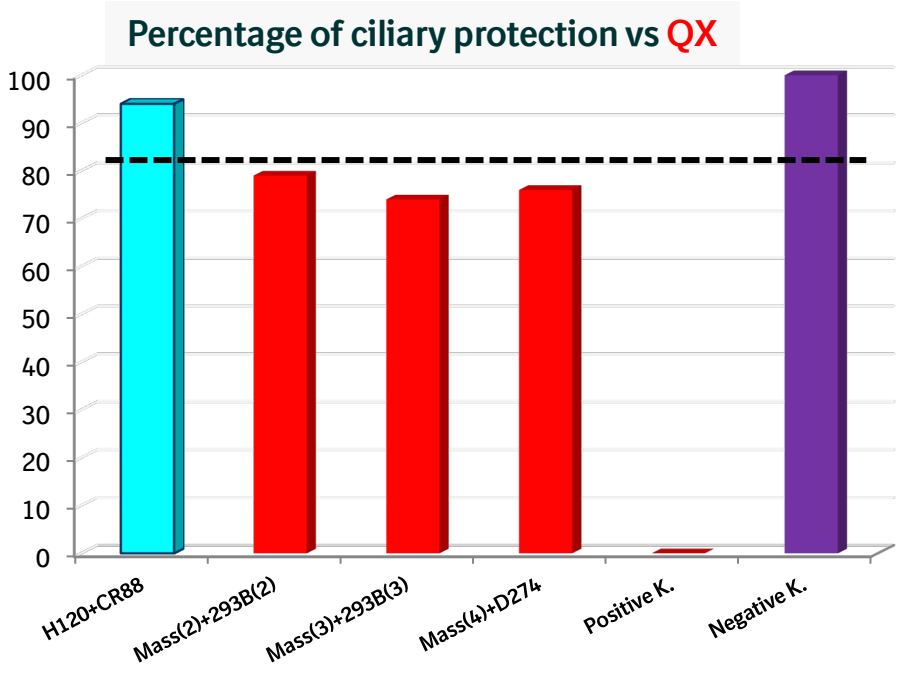
➢ **Vaccination with H120 and CR88 at day-old and optional revaccination with CR88 at day 14 provided good protection against the virulent IBVs.**

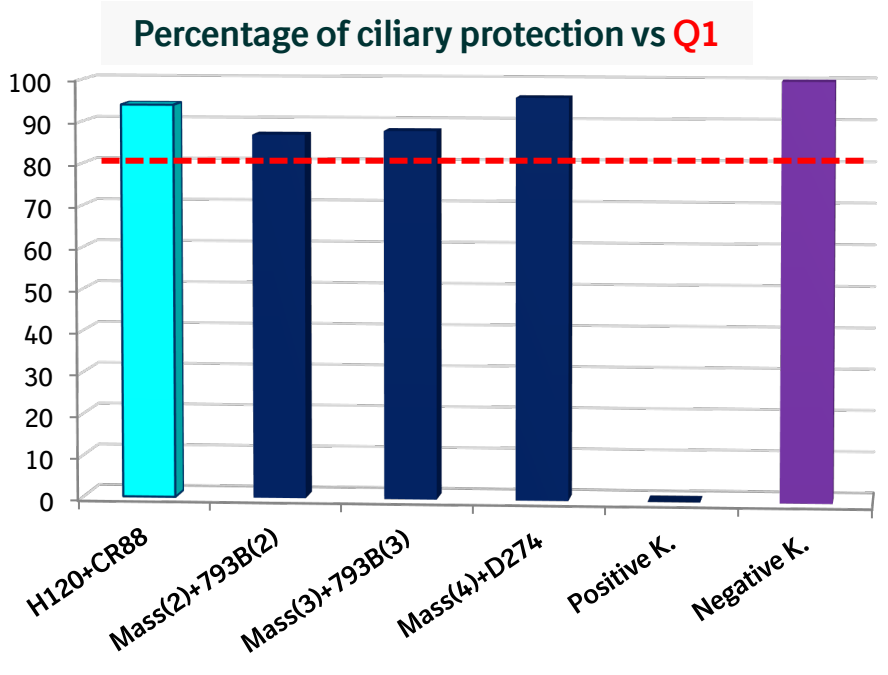
Virulent IBV cross-protection challenge studies in broiler (GD-AHS DEVENTER)

Protocol

- Groups of commercial broilers in isolators
- Day 1 - Vaccination:
  - H120 + IB88
  - Mass(2) + 793B(2)
  - Mass(3) + 793B(3)
  - Mass(4) + D274
  - Positive K.
  - Negative K.
- Day 28 - Challenge with **QX** or **Q1**
- Day 33 - Ciliostasis test → protection %

PROTECTION AGAINST CHALLENGE (GD-AHS DEVENTER)





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CONTROL OF VARIABLE IBV PROBLEMS

Vaccination with two IBV serotypes

IS BROADENING PROTECTION

- ✓ Clear evidence that a proper combination of Mass-type Bioral H120 and 793B-type Gallivac IB CR88 vaccines provides good protection against third IB Variants
- ✓ Re-vaccination with the same serotype enhances the immune response
- ✓ Vaccination with two serotypes can give greater protection against a third serotype than either vaccine applied alone
- ✓ Cross-protection between strains cannot be predicted ➔ lab / field investigation needed

BEAT IB WITH THE HETEROTYPIC™ STRATEGY

PROGRAMS + VACCINES + SERVICES