innovax®

vaccines

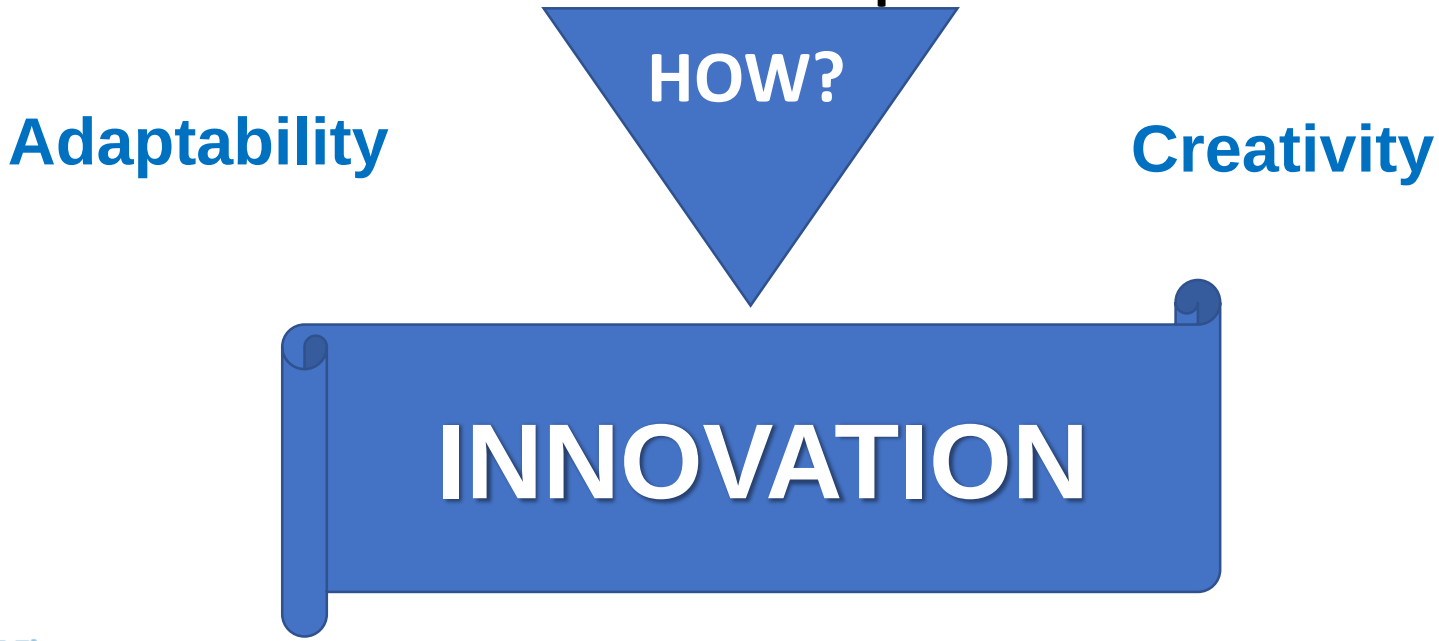
WHY WE INNOVATE

Marianna Andreopoulou, MSD AH

innovax® ND-IBD

MSD Animal Health

- Need for protein-increasing population
- Need for productivity
- Need for animal welfareNeed for sustainability
- Need for disease prevention
- Need for affordable production cost



innovax

Genetic selection, Feed composition and Disease control

Broilers grow faster and have shorter life cycle

How to keep broiler production efficient?

Adaptability ?

HOW?

Creativity

INNOVATION

innovax

Vaccine development

- Develop vaccines for use in the hatchery
- Develop combination vaccines
- Develop vaccines without vaccination reactions
- Develop equipment to reduce labor cost and increase accuracy of application

Adaptability

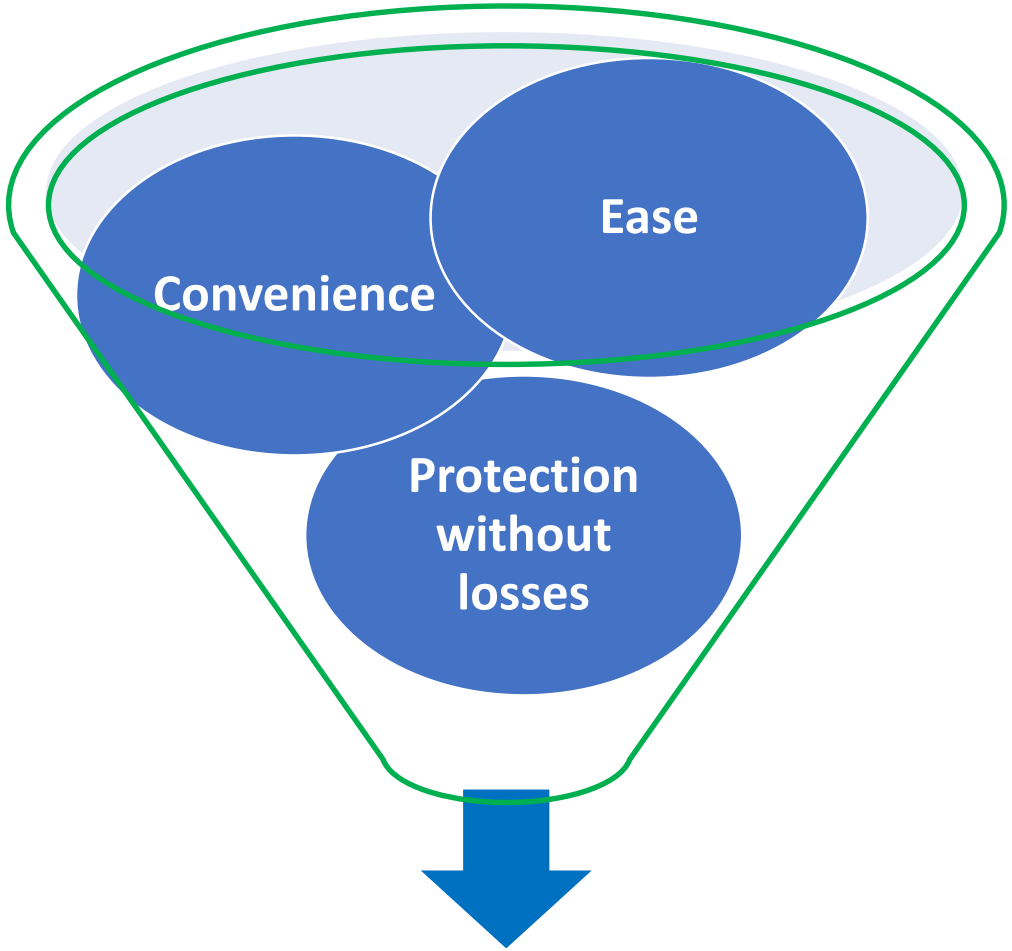
HOW?

Creativity?

INNOVATION

innovax

OUR AIM



HVT-constructs

innovax

ADVANTAGES OF HVT AS A VECTOR VACCINE

Known safety record > 40 years of HVT use – apathogenic in chickens

Ease of use – in ovo, s/c or i/m

Protection against oncogenic serotype 1 MDV strains

Breaks through maternally derived antibody

Early then persistent life-long replication within a flock

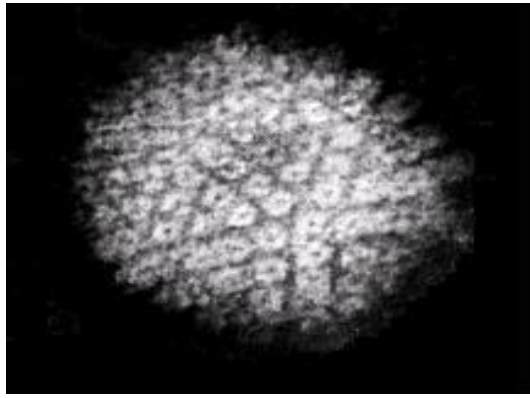
Large coding capacity for heterologous antigens ~ 150kb

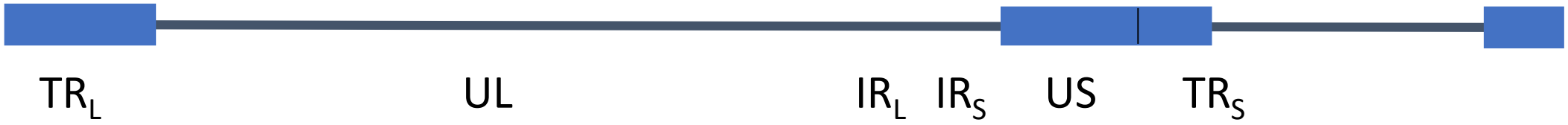
Has genomic regions with no apparent function to insert genes

Stability of encoded antigens

30+ years knowledge of HVT vector research

Vectors commercially available expressing ILT, IBDV, AI, ND genes and, more being developed – over 10 billion doses sold



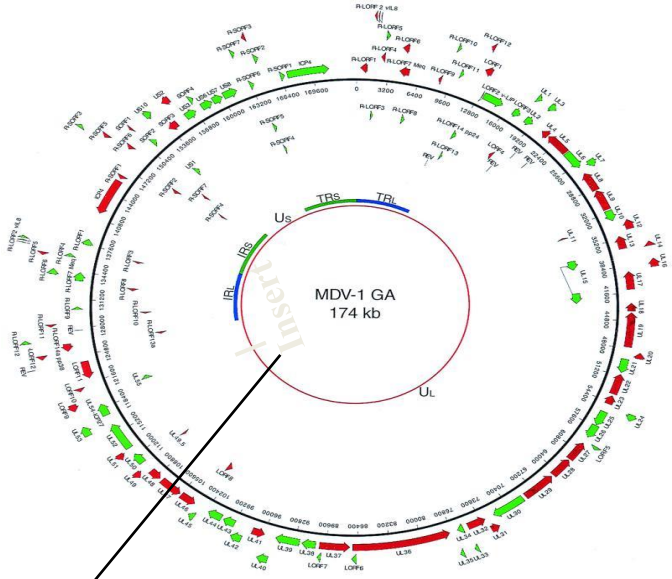


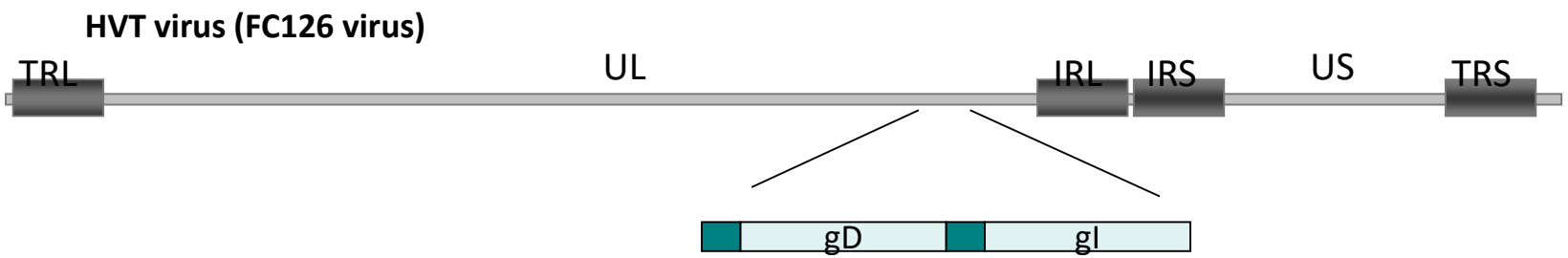
70-80 genes to associate with biological functions

OUR INNOVAX RANGE

2 IN 1 PROTECTION
MAREK + ILT

innovax® ILT





ILT virus insert
(genotype 1, US strain)

innovax®

WHY DEVELOP INNOVAX-ILT?

ILT is a worldwide problem-outbreaks also the

Concerns of the use of conventional live ILT vaccines

- Labor
- Reversion to virulence for CEO vaccines
- Post-vaccine reactions
- Duration of protection

Need for convenient combination of vaccines <u>at the hatchery</u>

- Onset of immunity (OOI): ILT: 4 weeks, MD: 9 days.
- Duration of immunity (DOI): ILT: 60 weeks, MD: entire risk period.

VIRAL FLEX-SEQ

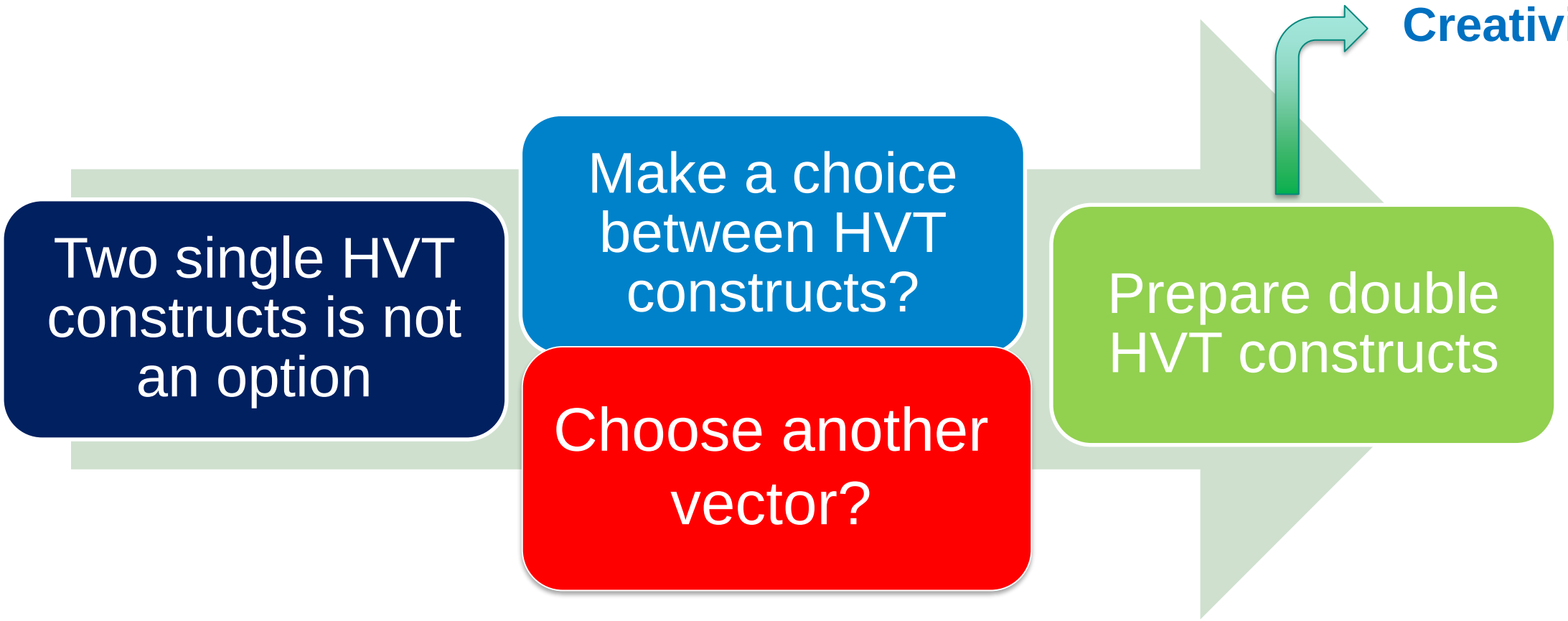
Our support:

- Transition from CEO to Innovax-ILT
- Biosecurity/Farm management in multi-age farms
- Hatchery vaccination support with our Convenience Program

innovax

Convenience Program

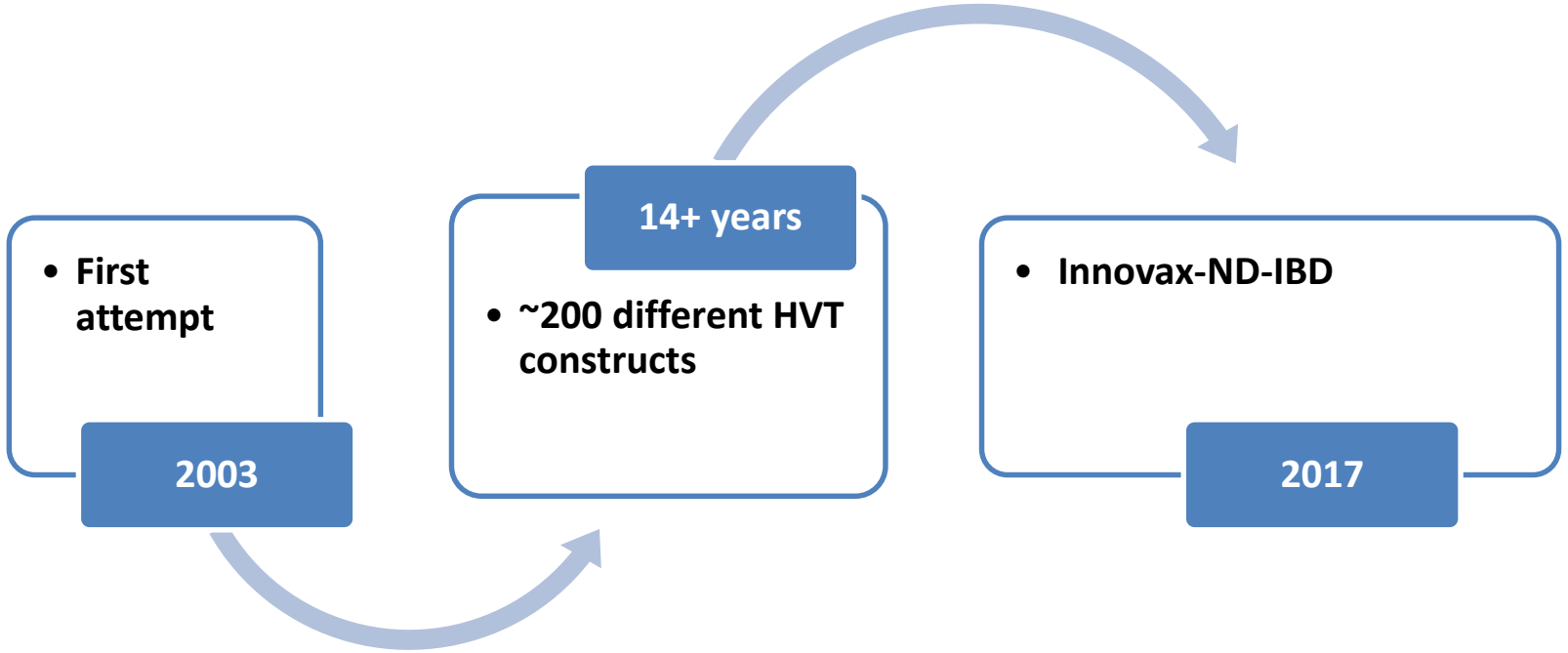
LIMITATIONS OF SINGLE HVT-CONSTRUCTS



OUR INNOVATION IS CALLED

Creativity

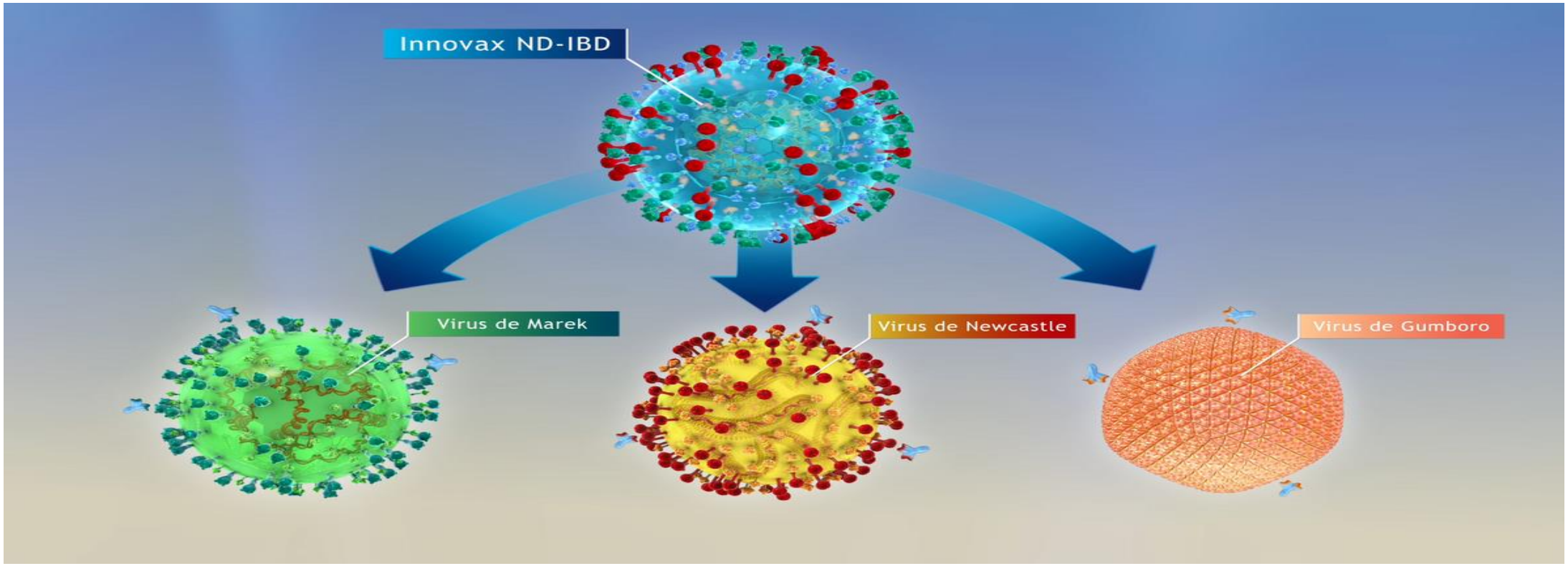
innovax® ND-IBD



THE FIRST DUAL-CONSTRUCT VACCINE!

The first HVT vector dual construct vaccine protecting against Marek disease (HVT), Newcastle disease (ND) and Infectious Bursal Disease (IBD)

<u>with a single injection</u>.



innovax

BUT WHY WE NEED INNOVATION?

For business survival

For improved performance

For better returns

(Lorraine Yapps Cohen: “Top 10 reason why we need innovation”)

BUT WHY WE NEED INNOVATION?

For business survival

- **Newcastle Disease**
  - **High mortality**
  - **Strong vaccination is necessary**

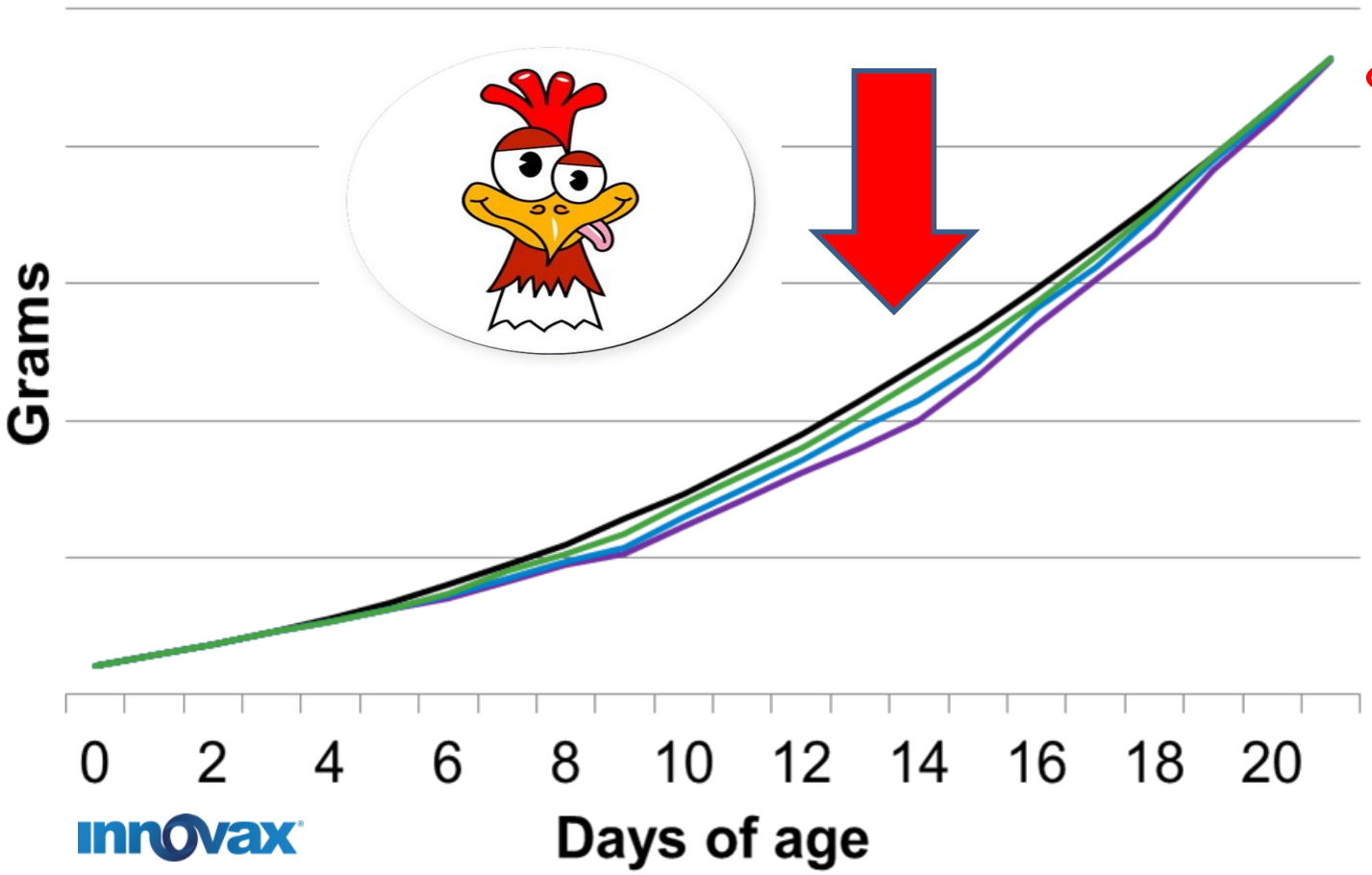
innovax

BUT WHY WE NEED INNOVATION?

BUT WHY WE NEED INNOVATION?

For improved performance

Live vaccines at day-old chicks?



Age	Control (g)	Cl. Lasota (g)	B1 (g)	C2 (g)
7 days	161	147	147	146
14 days	443	419	430	432
21 days	883	881	882	889

(Teeter et al., 2012)

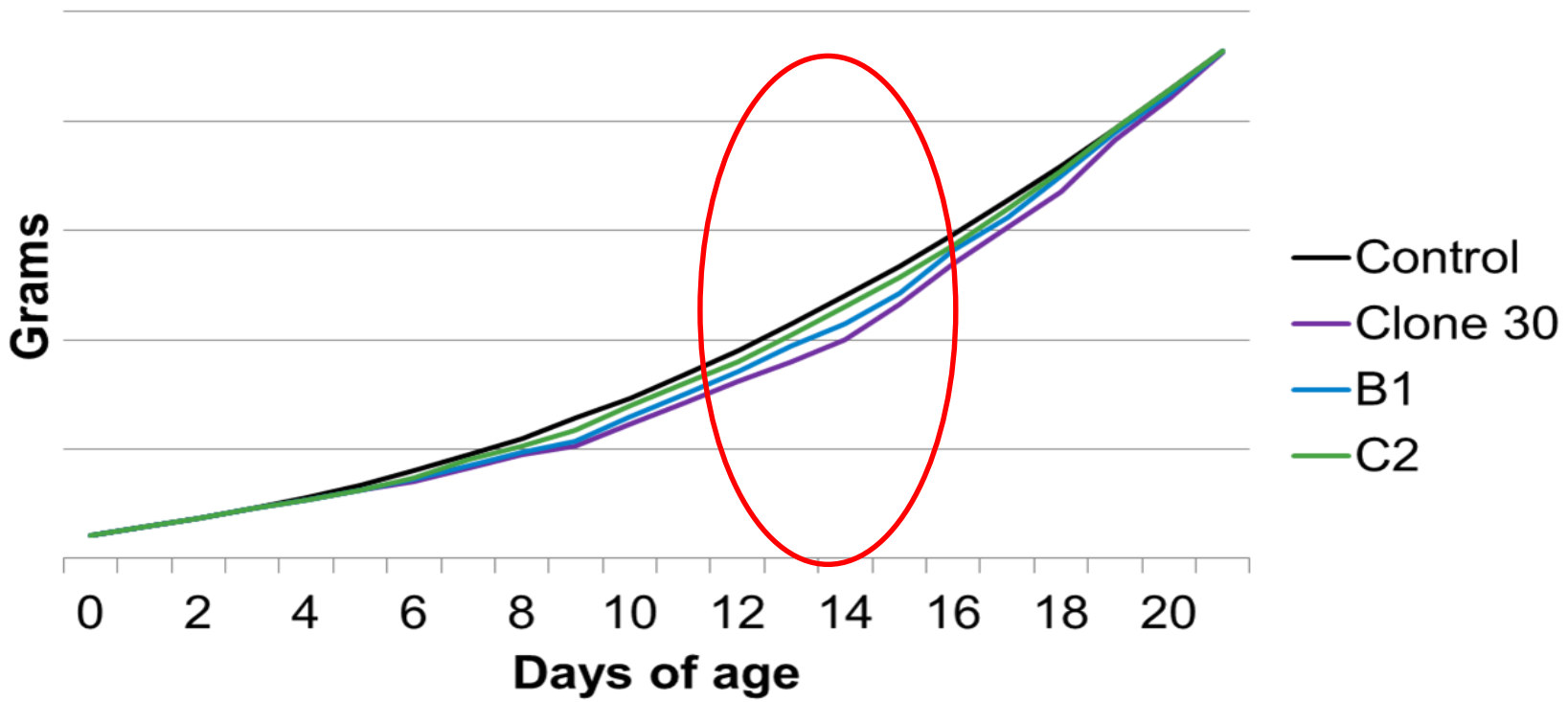
BUT WHY WE NEED INNOVATION?

For improved performance

Re-vaccinate in the field

Even vaccination is never achieved

53% with spray and 60% through the drinking water (Degefa *et. al.* 2004)



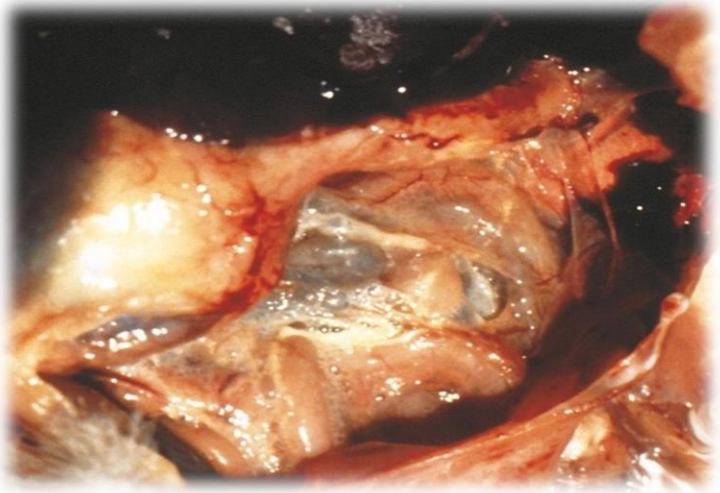
innovax

BUT WHY WE NEED INNOVATION?

For improved performance

Stress + Uneven coverage = ?

- Affected epithelial integrity
- Affected immunocompetence
- Airsacculitis
- Secondary infections
- Loss of up to 2 days growth



For better returns

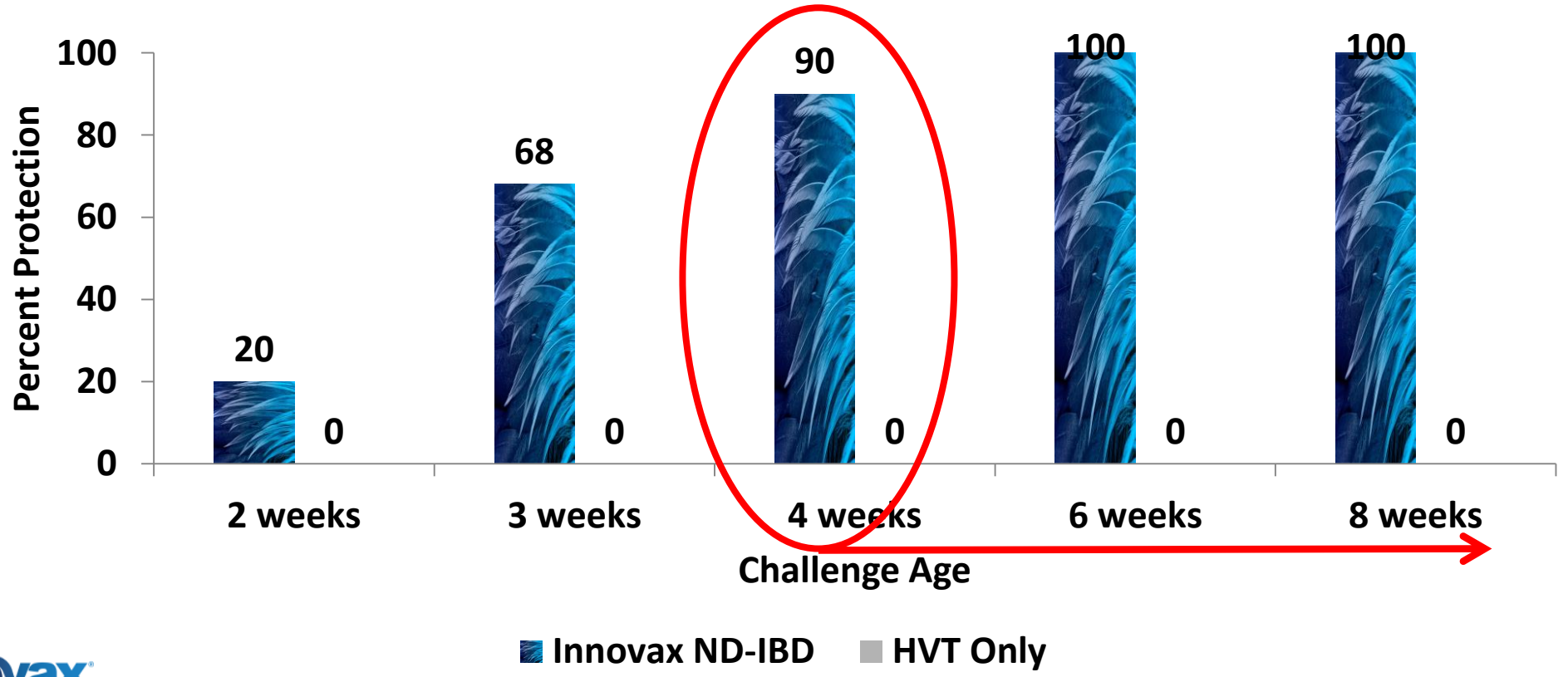
- Increase of FCR
- Increase of treatment cost

innovax

WHY IS INNOVAX-ND-IBD A TRUE INNOVATION?

For business survival

Newcastle Disease protection:
Onset and duration of Immunity: Herts NDV strain

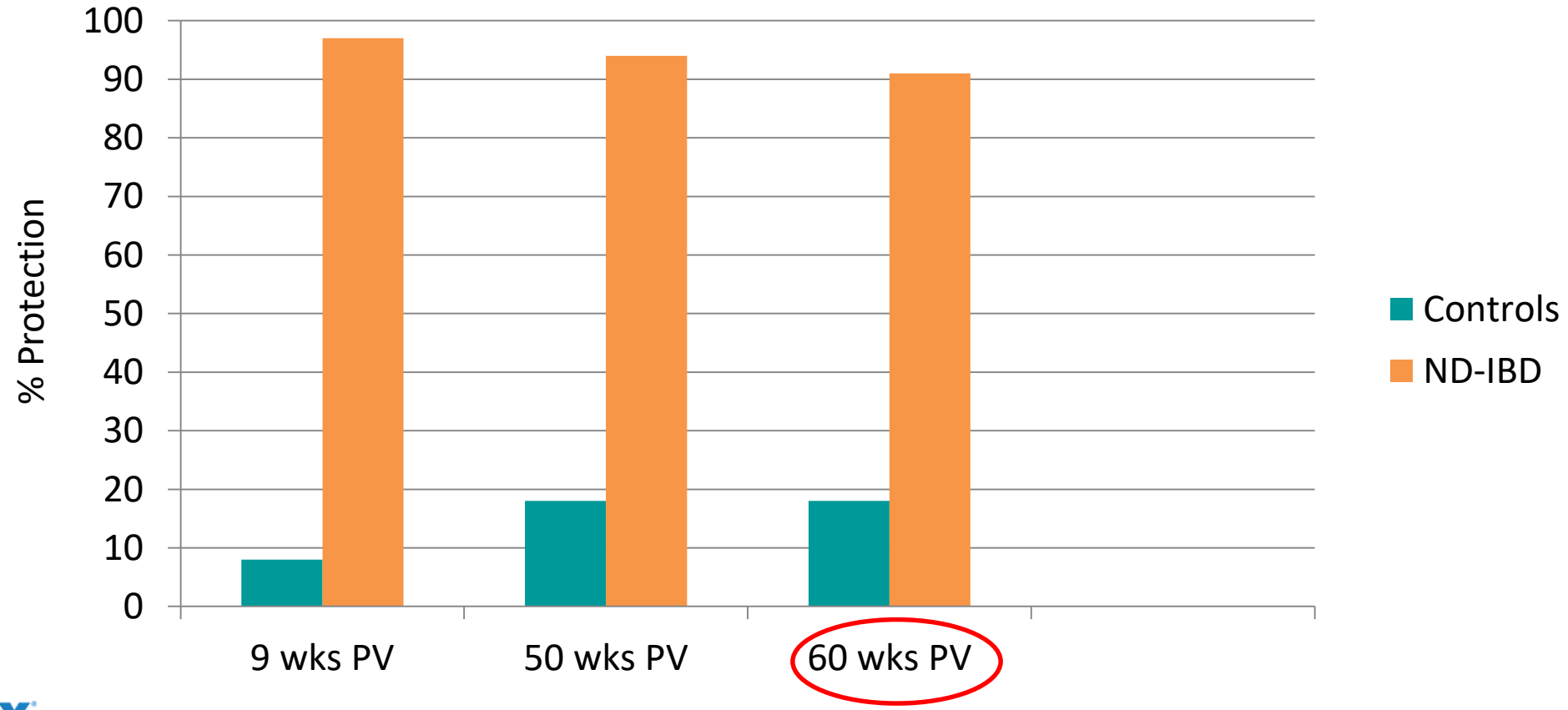


innovax

WHY IS INNOVAX-ND-IBD A TRUE INNOVATION?

For business survival

Newcastle Disease protection: Duration of Immunity: NDV Texas GB efficacy



innovax

WHY IS INNOVAX-ND-IBD A TRUE INNOVATION?

For improved performance

Age	Control (g)	Innovax ND (g)
7 days	161	163
14 days	443	439
21 days	883	903

(Teeter et al., 2012)

NO STRESS!

NO BOOST!

innovax

WHY IS INNOVAX-ND-IBD A TRUE INNOVATION?

For improved performance ☺

Stress + ven co = ?

- Af
- Affect etence
- Airsac
- Sc
- Loss to 2 days th

For better returns ☺

- Increas
- Increase tment cost

innovax

BUT WHY WE NEED INNOVATION?

For business survival

For improved performance

For better returns

IMMUNOSUPRESSION

(Lorraine Yapps Cohen: “Top 10 reason why we need innovation”)

IMMUNOSUPRESSION

BUT WHY WE NEED INNOVATION?

For business survival

IBD : severe immunosuppression

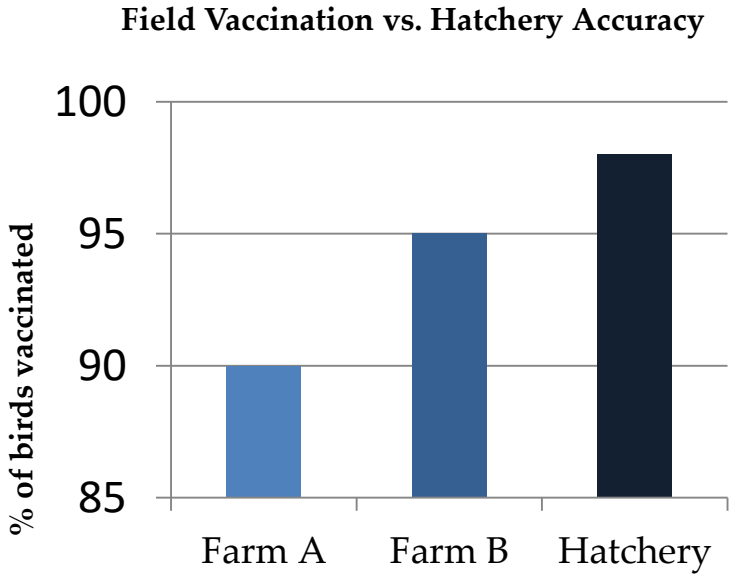
Survival of the business came through live vaccination

BUT : timing , accuracy, post-vaccine reaction??

For improved performance

For better returns

Hatchery vaccination ☺



innovax

IMMUNOSUPRESSION

BUT WHY WE NEED INNOVATION?

For improved performance

For better returns

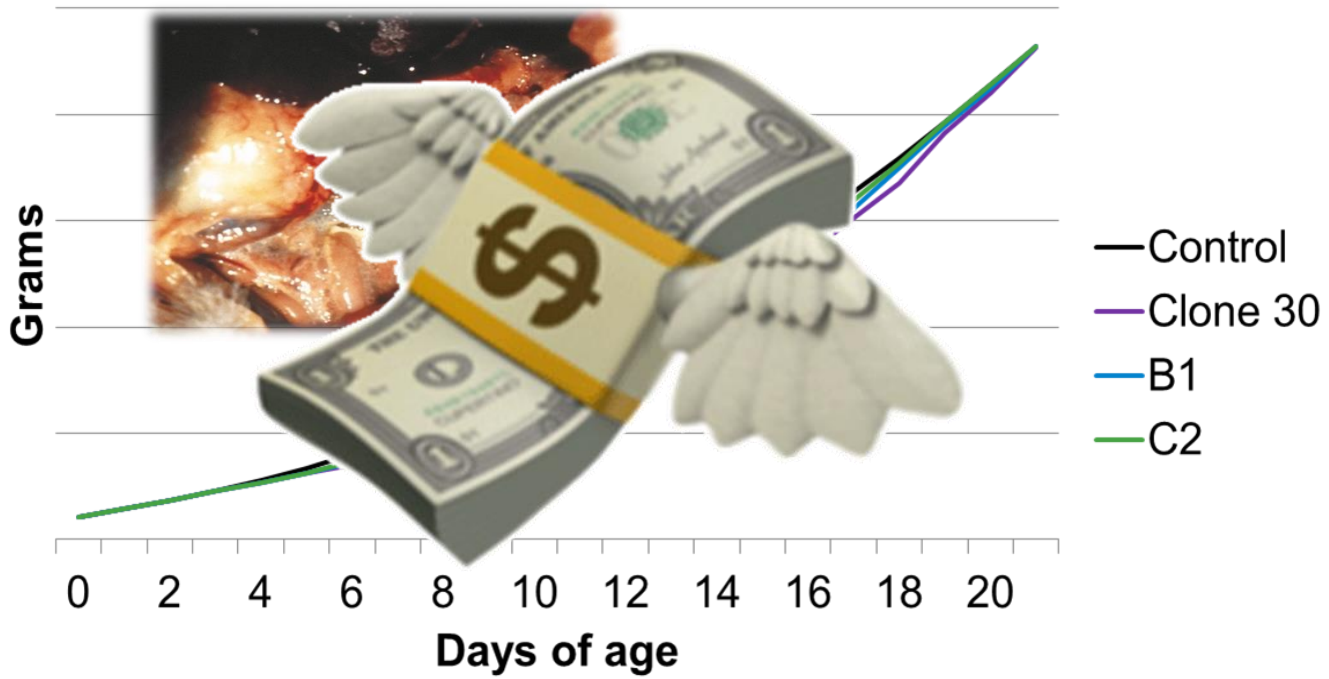
Hatchery vaccination ☺

IC vaccines ☹

- Cause severe lymphoid depletion
- Cause immunosuppression
- Co-existing pathogens ruin performance

HVT-IBD vaccines ☹

- Safer than IC vaccines
- Still need for strong live ND vaccination
- Still performance losses

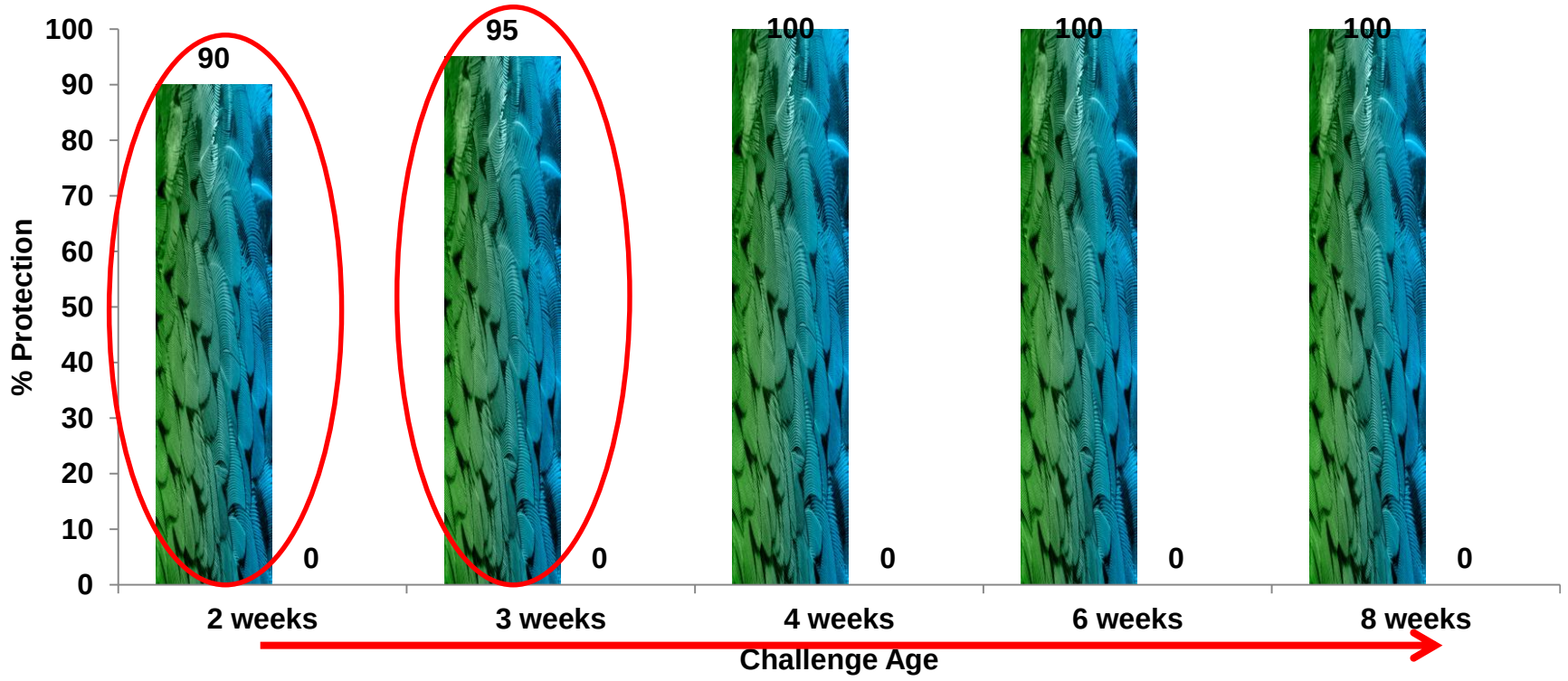


innovax

WHY IS INNOVAX-ND-IBD A TRUE INNOVATION?

For business survival

vvIBDV protection Onset and duration of Immunity: Strain CS-89



+ variant Delaware E studies

innovax

WHY IS INNOVAX-ND-IBD A TRUE INNOVATION?

For improved performance

The bursa does not show severe vaccine-derived lymphoid depletion

The vaccine itself is not another cause of immunosuppression

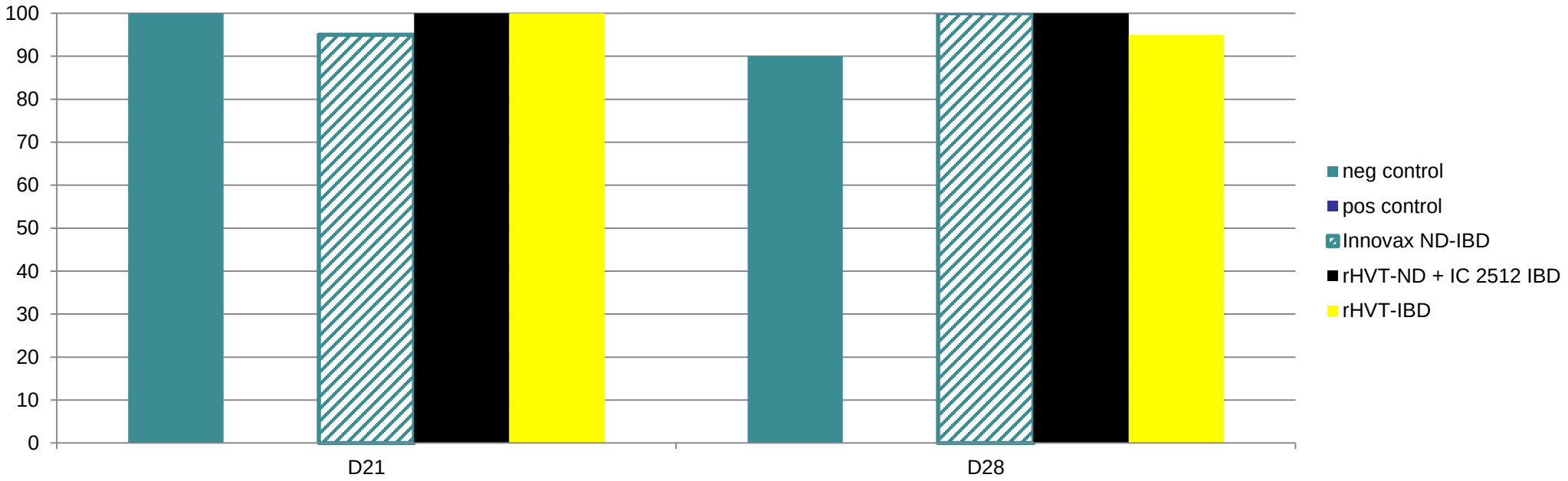
The immune system is stronger to fight co-existing challenges

TRUE OR FALSE?

WHY IS INNOVAX-ND-IBD A TRUE INNOVATION?

For improved performance

AVERAGE CLINICAL PROTECTION
AFTER IBD CS89 CHALLENGE AT D21 & D28

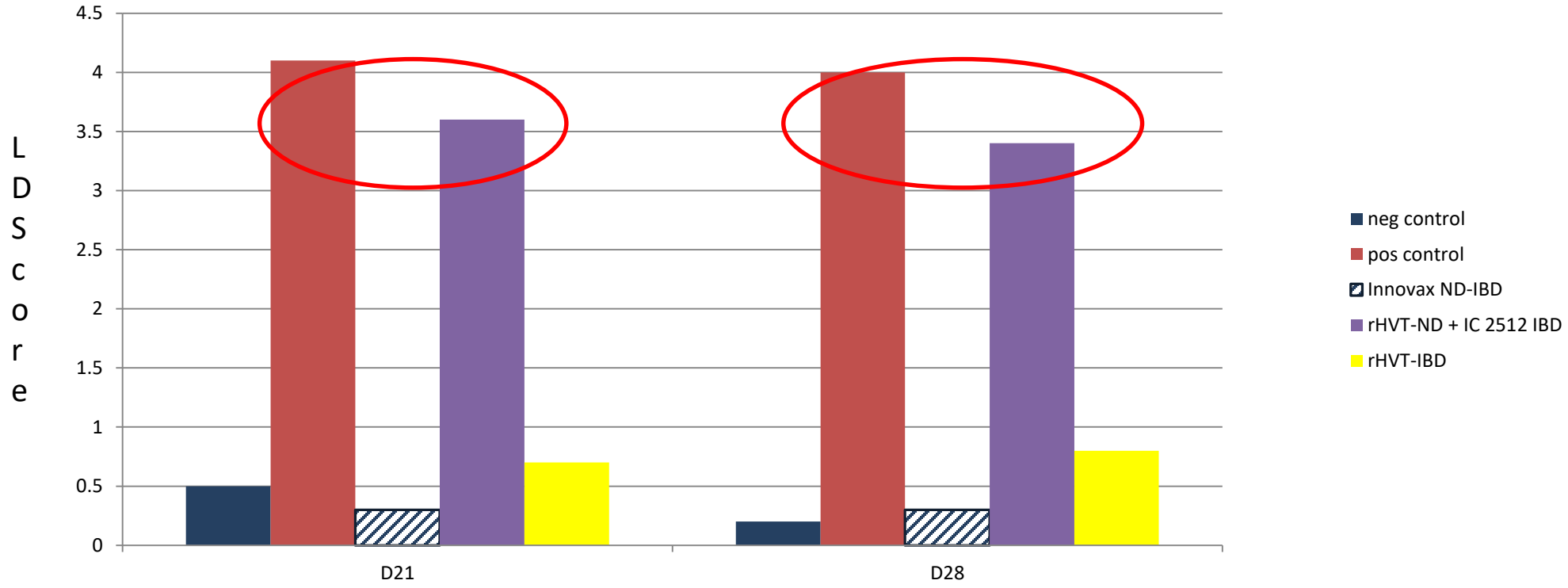


innovax

WHY IS INNOVAX-ND-IBD A TRUE INNOVATION?

For improved performance

LYMPHOID DEPLETION SCORE AFTER IBD CS89 CHALLENGE AT D21 &D28



LD score: 0= normal bursa; 1= 1-25% LD; 2= 26-50% LD; 3= 51-75% LD; 4=76-100% LD; 5= 100% LD

**LD Lymphoid Depletion*

[1] LD score at 3 days post challenge

WHY IS INNOVAX-ND-IBD A TRUE INNOVATION?

For improved performance

The bursa does not show severe vaccine-derived lymphoid depletion

The vaccine itself in not another cause of immunosuppression

The immune system is stronger to fight co-existing challenges

BUT WHY WE NEED INNOVATION?

For business survival

For improved performance

For better returns

(Lorraine Yapps Cohen: “Top 10 reason why we need innovation”)

innovax

BUT WHY WE NEED INNOVATION?

For business survival

MDV is always present

For improved performance

For better returns

Immunosuppression ruins performance

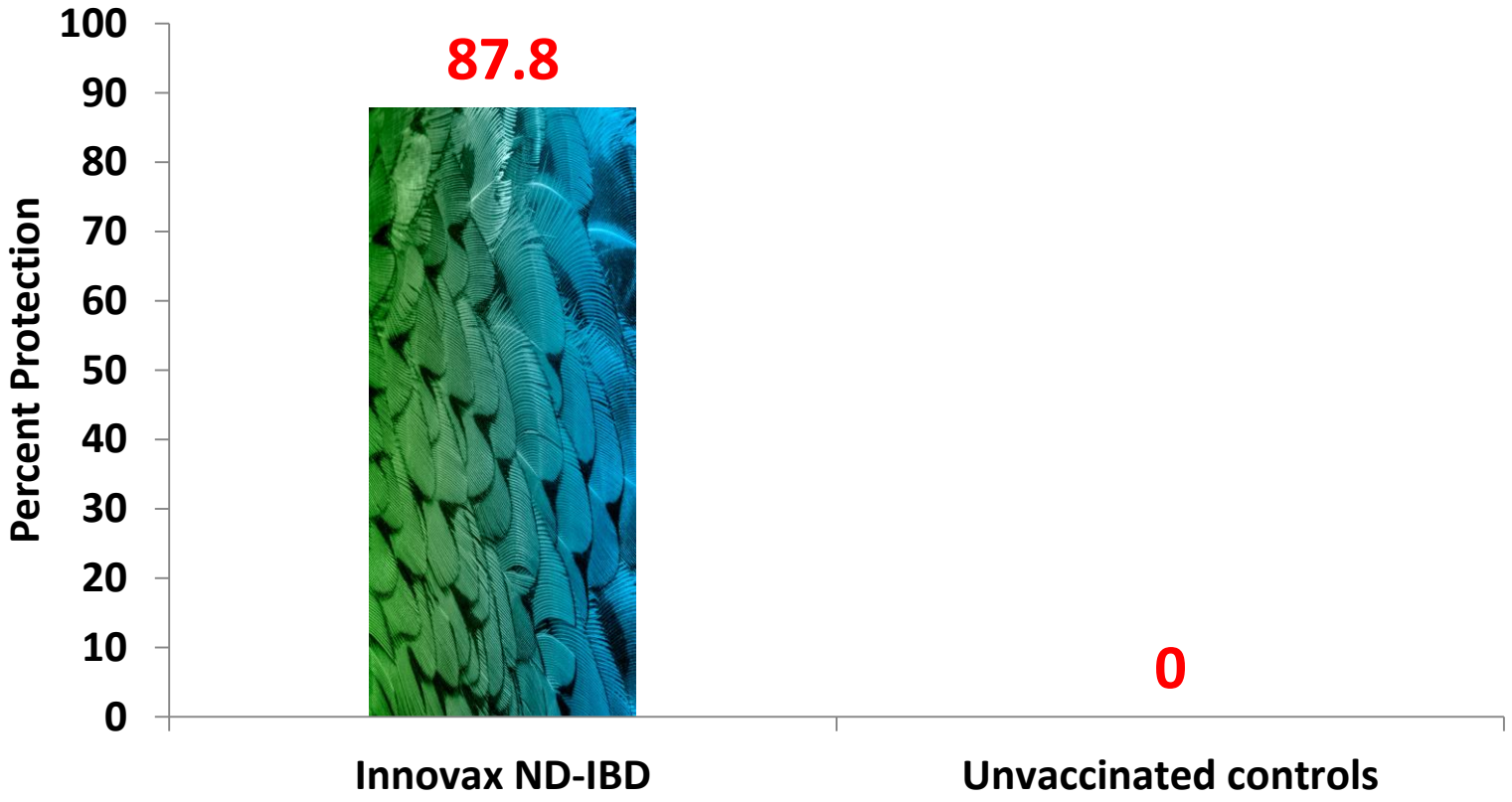
Never underestimate subclinical cases

innovax

WHY IS INNOVAX-ND-IBD A TRUE INNOVATION?

For business survival

Marek's Disease Protection: RB1B challenge at 9 days of age



innovax

WHY IS INNOVAX-ND-IBD A TRUE INNOVATION?

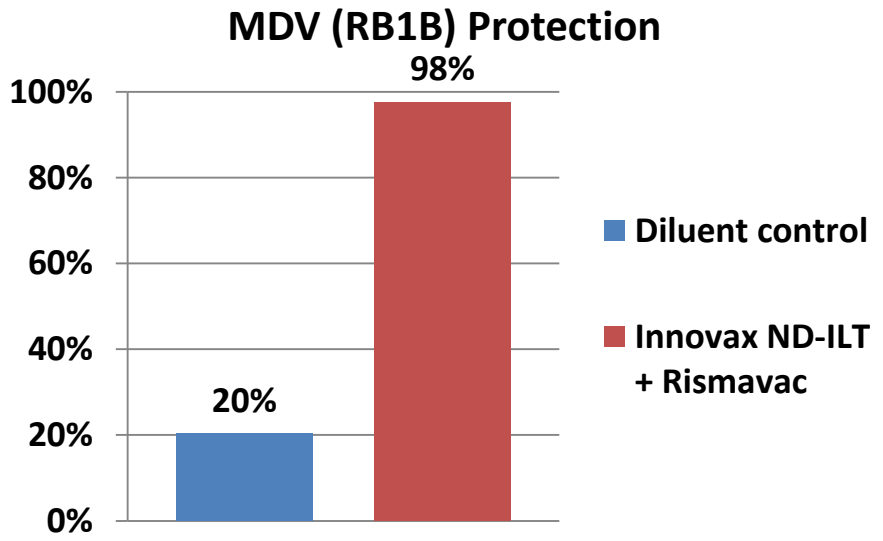
For business survival & Improved performance

Compatibility with Nobilis Rismavac (Rispens strain CVI-988): ✓

Other vaccines of Innovax range have already approval for use with Nobilis Rismavac.

DOI studies for ND were <u>with</u> Rispens → compatibility ✓

Treatment	Challenge	> 85% protection
Innovax-ILT +Rismavac	RB1B (9d)	✓
Innovax ND-SB +Rismavac	RB1B (3d)	✓
Innovax ND-ILT +Rismavac	RB1B (9d)	✓



innovax

WHY IS INNOVAX-ND-IBD A TRUE INNOVATION?

For business survival

For improved performance

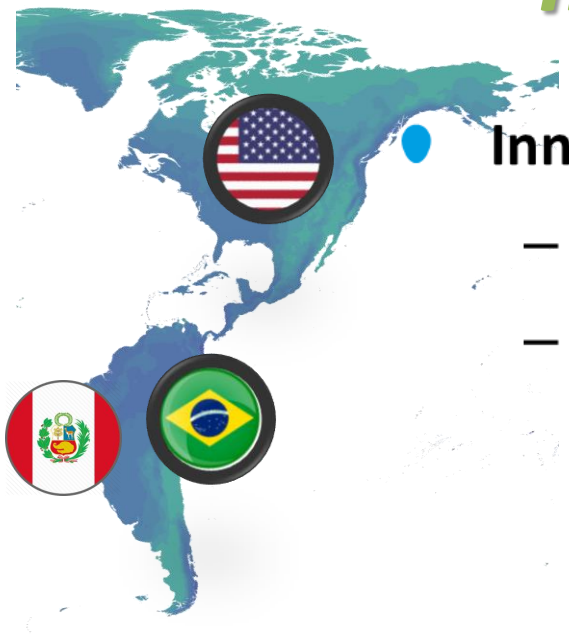
For better returns

innovax

INNOVAX-ND-IBD IN THE FIELD

innovax

INNOVAX-ND-IBD IN THE FIELD



Innovax-ND-IBD vs rHVT-ND

- +2 gr ADG
- FCR decrease by 5 points
  - 1 point FCR = $6000
  - **5 point FCR = $30,000/week**

12 m broilers

- rHVT-ND+IC IBD+ Ma5 vs Innovax-ND-IBD + Ma5
  - +59 gr BW ($ 296.694,00)
  - -13g FCR ($ 129.238,00)
  - ROI: 1: 4.3

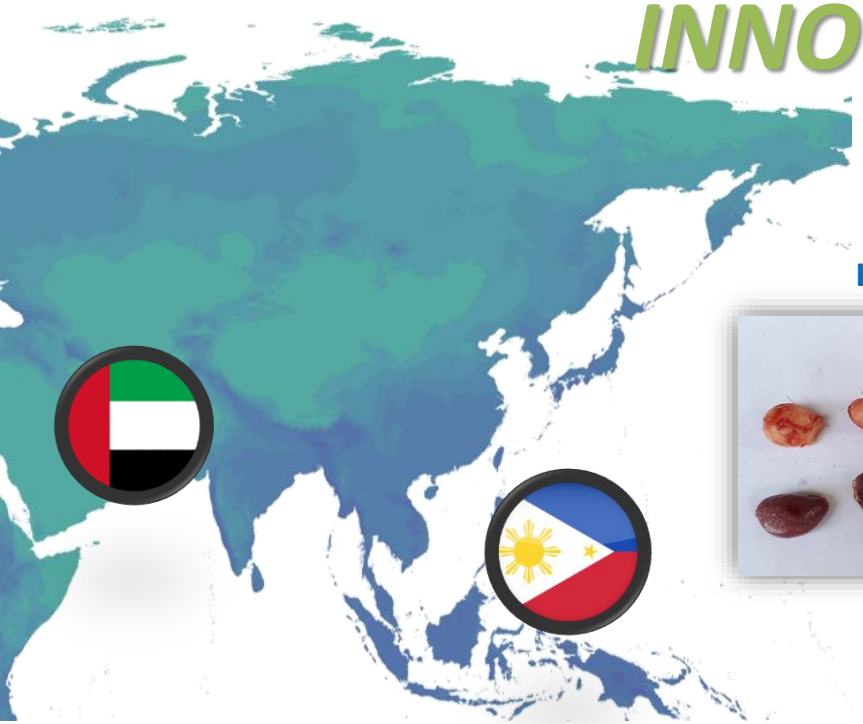
rHVT-ND+IC IBD+ NDC2 vs Innovax-ND-IBD + NDC2

- +38g ABW
- 4 points FCR difference
- ~ $ 36500 more per 100,000 birds
- ROI 1:12

innovax® ND-IBD

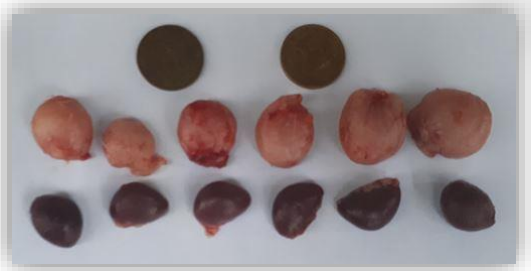
innovax rHVT-ND +2512 IC

INNOVAX-ND-IBD IN THE FIELD



rHVT-ND + IC2512

INNOVAX ND-IBD



rHVT-ND+IC 2512 IBD vs Innovax-ND-IBD

- +60 gr ABW
- 7 points FCR difference
- $ 84,248.76/ year

Increased net profit to $240/1000 birds

Vaccination program	Farm 10, 146000 birds	Farm 9, 134000 birds	Application
Day 18 (In Ovo)	Innovax-ND-IBD	rHVT-ND & IC IBD + Inactivated ND	Injection
Day old	IB H120 + Clone 30 Nobilis AI	IB H120 + Clone 30 +Nobilis ND+AI	*CS*
8 Day old	Clone30 + IB 4/91	Clone30 + IB 4/91	*CS*
14 days	PHY.LMV.42	PHY.LMV.42	*DW*

- -0.82% mortality
- +58 gr/bird ABW
- $221212 for 1m birds
- 5 points lower FCR
- $19000 for 1m birds

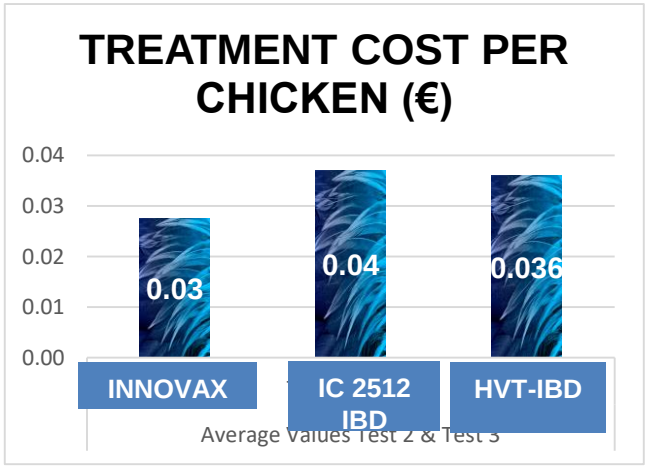
innovax

INNOVAX-ND-IBD IN THE FIELD

INNOVAX ND IBD, NDC2, Ma5, 4-91 vs IC 2512 IBD, rHVT-ND, IB Mass, IB 1/96

7.7 points FCR difference

overall better performance after 5 cycles



- **2017-2018**:
  - **11.7%** body weight increase
  - **0.13** average FCR decrease
  - **10% lower** treatment costs
  - **~$ 0.5m more** for 1m birds

Innovax-ND-IBD vs rHVT-IBD vs IC IBD

- **3** points FCR difference vs IC IBD
- **9** points FCR difference vs rHVT-IBD
- **+530** gr ABW vs IC IBD (~15,000 € more per 25,000 birds)
- **REDUCTION OF ANTIMICROBIALS USE**

innovax

CONCLUSIONS

IC IBD vaccines affect bursal integrity and performance

- **Consistent FCR difference**
- **Worldwide**

Even compared to other rHVT-vaccines, Innovax ND IBD performance is better

- **No ND in the field**
- **Uninterrupted body weight gain**

Lower treatment costs

- **Reduced usage of antimicrobials**
- **Better immunocompetency of the flock**
- **Less secondary infections due to live vaccines**

CONCLUSIONS

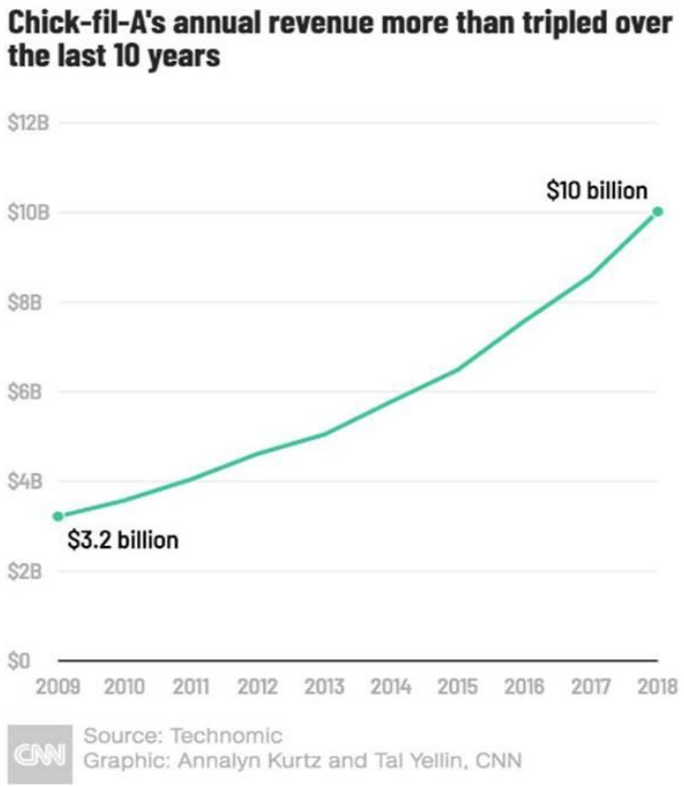
McDonald's failed to meet quarterly earnings expectations, stock is 5% down. WHY? They are losing the Chicken Sandwich war by Chick-fil-A

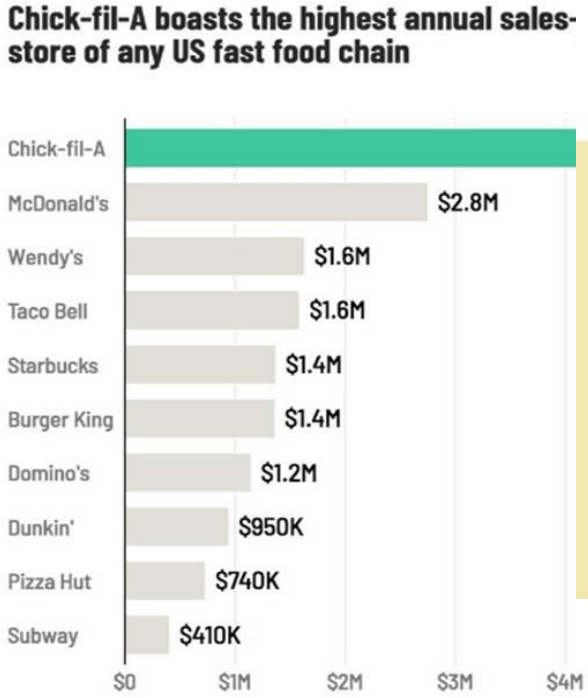
https://www.marketwatch.com/investing/stock/mcd/financials

McDonald's sales growth:	$ Bn
2014	$44
2015	$25.41
2016	$24.62
2017	$22.82
2018	$21.03

CONCLUSIONS

Chick-fil-A is a No Antibiotic Ever chain and is strongly promoting their NAE position!





Chick-fil-A®

innovax® = INNOVATION

SO WHY WE NEED innovax® ?

- For business survival ✓
- For improved performance ✓
- For better returns ✓

(Lorraine Yapps Cohen: “Top 10 reason why we need innovation”)

Innovation is the only way to win.

Steve Jobs

ALWAYS PRODUCING MORE!

#WhyWeInnovate

THANK YOU FOR YOUR ATTENTION. QUESTIONS?

ND-IBD