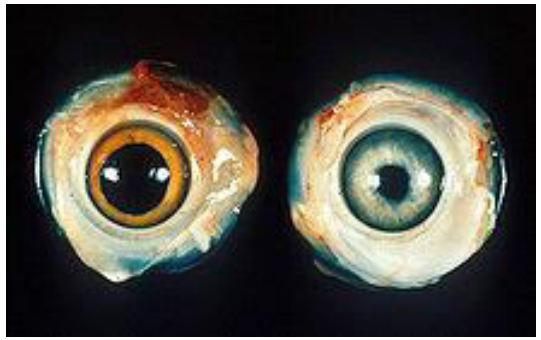
HATCHERY VACCINATION: CATCHING THE FUTURE

Dr. SANJAY GAVKARE

General Manager (Technical)

Venkateshwara Hatcheries Pvt. Ltd, PUNE

HISTORY OF HATCHERY VACCINATION

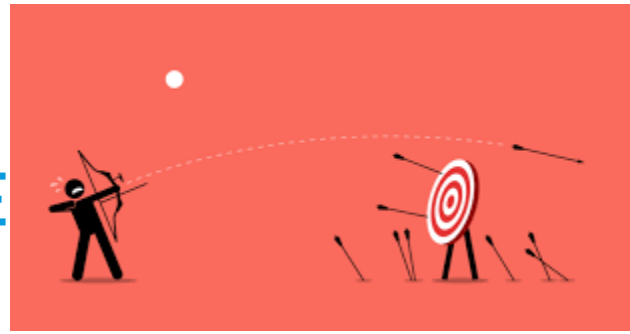


- Late 1960's : First practice of subcutaneous hatchery vaccination against Marek's using a live attenuated strains. Ex: HVT, SB1, Rispen's etc.
  - These vaccines are cell associated effective and efficacious even in the presence of Mabs.

- **In 1982: *In-ovo* vaccination** as a mean of hatchery vaccination against MD

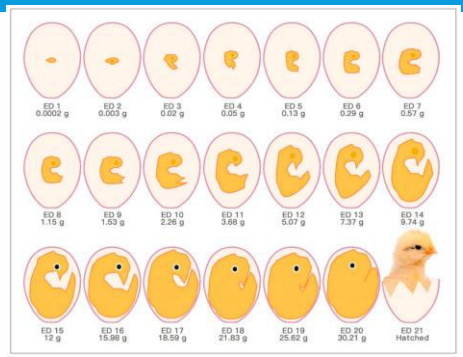
- **In 1995:** *In-ovo* vaccination against IBD and recently against ND, ILT, IBV and fowlpox.

REASONS FOR ADAPTING HATCHERY VACCINATION WORLDWIDE



- Precise uniform delivery of vaccines compared with other mass vaccination techniques such as coarse spray or water vaccination.
- Reduces stress in chickens associated with animal handling at farm level.
- High output automated vaccine delivery equipment results in reduced labor cost at the farm level.
- Inducing early immune responses than post-hatch vaccination.

IMMUNE SYSTEM FEATURES DURING CHICKEN EMBRYOGENESIS



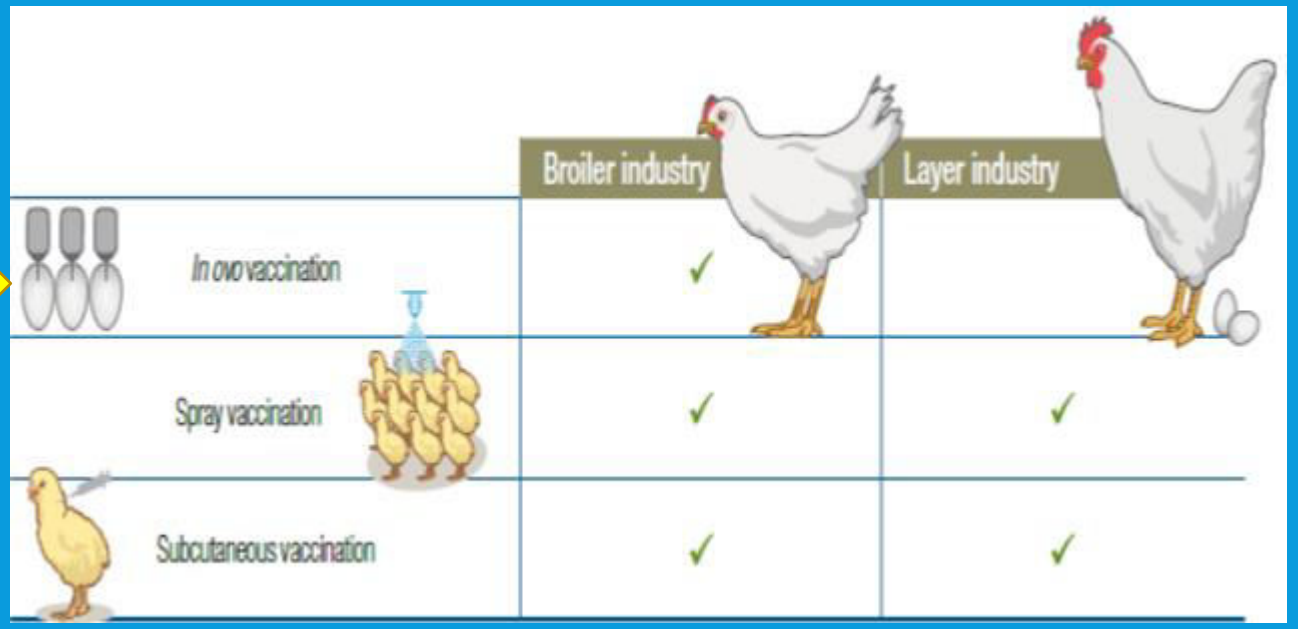
Day (ED)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Lymphoid organs				Thymus development																		HATCHING
					Bursa of Fabricius development																		
					Hematopoiesis in the yolk sac only										Hematopoiesis in yolk sac and bone marrow							
			• Spleen primordium									• Erythropoiesis in the spleen										
Lymphoid cells							Colonization of the thymus by progenitors															
									Colonization of the bursa by progenitors							Gene conversion in the bursa						
											• T cells					• γδ T cells migration						
						• Immunoglobulin rearrangement (*yolk sac*)								• Cell-mediated immunity						• αβ T cells migration		
												• B cells			• NK cells			• IgM⁺ B cells migration				
Antigen-presenting cells			• Hemopoietic precursors (yolk sac)						• Colonization of the epidermis (*Langherans cells*)													
				• TLRs							• Colonization of bursal, cecal and splenic mesenchymes (*tissue-specific dendritic cells*)											
			• Functional macrophage-like cells in yolk sac										• Macrophages in liver				• Macrophages in spleen					
Granulo-cytes								Granulopoiesis in the spleen														
								• Chemotaxis capability								• Granulocytic differenciation						
Cytokines				Secretion of cytokines and chemokines																		
				• IL-1β, IL−8, IL-12, IL−18									• IL-4, IL-10 and IFN-γ									

- The earliest points in time at which events were first observed and described.

CURRENT TRENDS IN HATCHERY VACCINATION PRACTICES

- *In-ovo* vaccination
- Spray vaccination
- Automated Subcutaneous vaccination

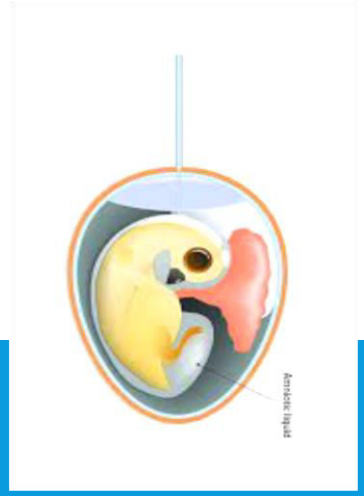
Practiced by Broiler chicken industry mainly in North and Latin America



DESIRABLE CHARACTERS OF HATCHERY VACCINES

- Safety
- Ability to withstand maternal antibody interferences
- Ability to induce innate responses
- Persistence of vaccine antigens
- Ability to induce adaptive responses and protection
- Compatibility among hatchery vaccines

IN-OVO VACCINATION



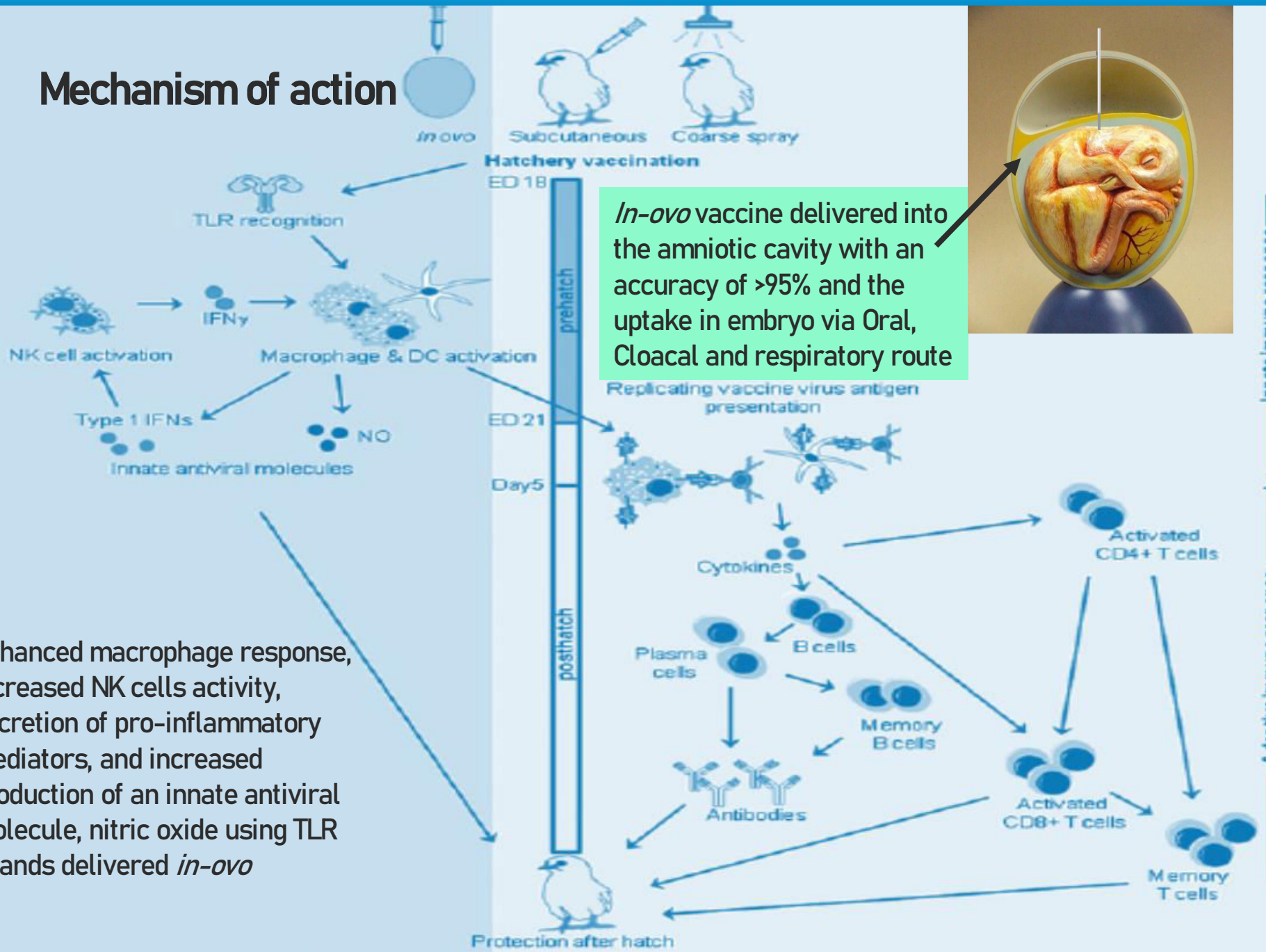
Ups

- Reduces stress on young chicks
- Allows early development of immunity
- Removes user error in vaccination
- Saves time and is less labour intensive
- Is easy to integrate with other automation e.g. candling

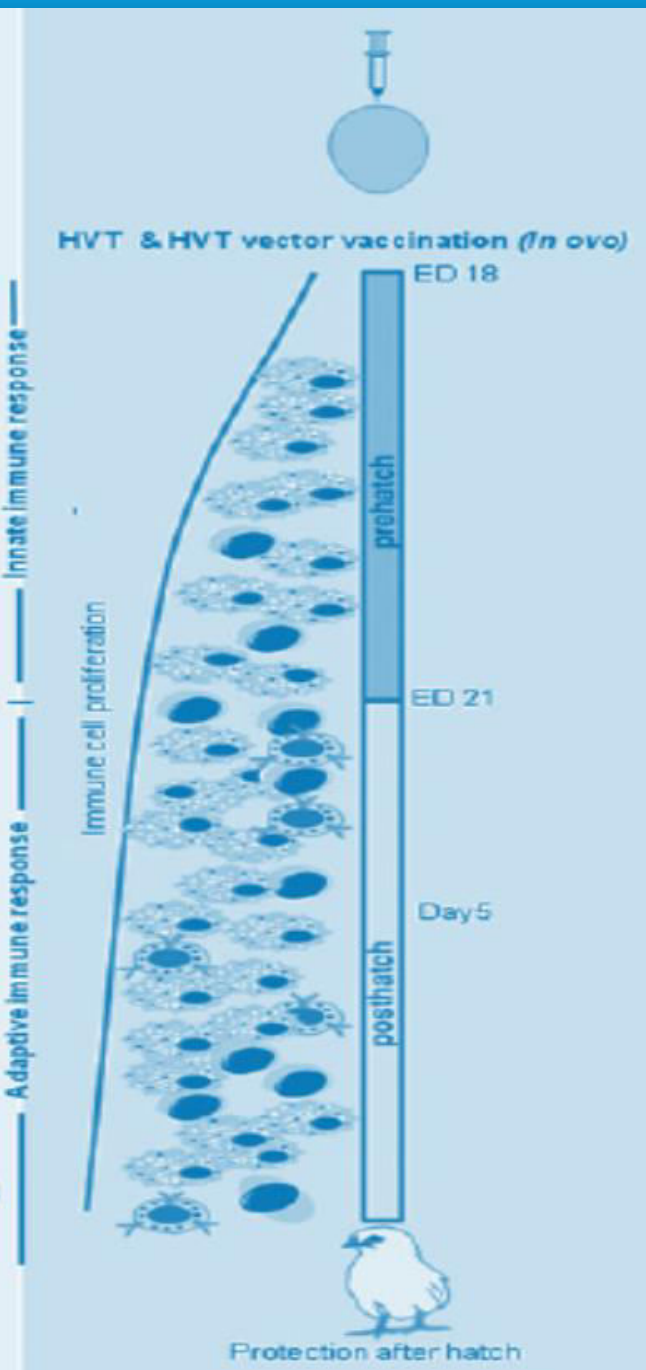
Downs

- Technology is initially expensive
- Requires skilled operators and strict biosecurity measures
- Not all important chicken diseases have an *In-ovo* vaccine
- Might not be economically viable if hatcheries are small
- Incorrect timing or needle placement can damage embryos

Mechanism of action

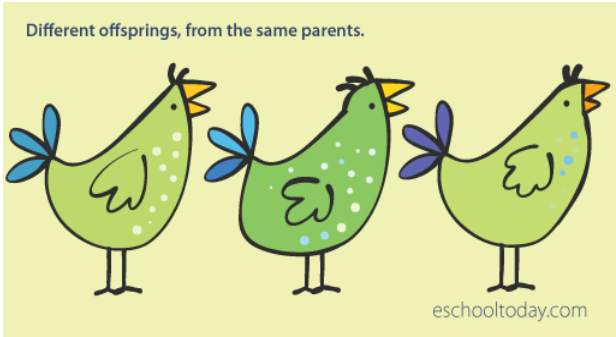


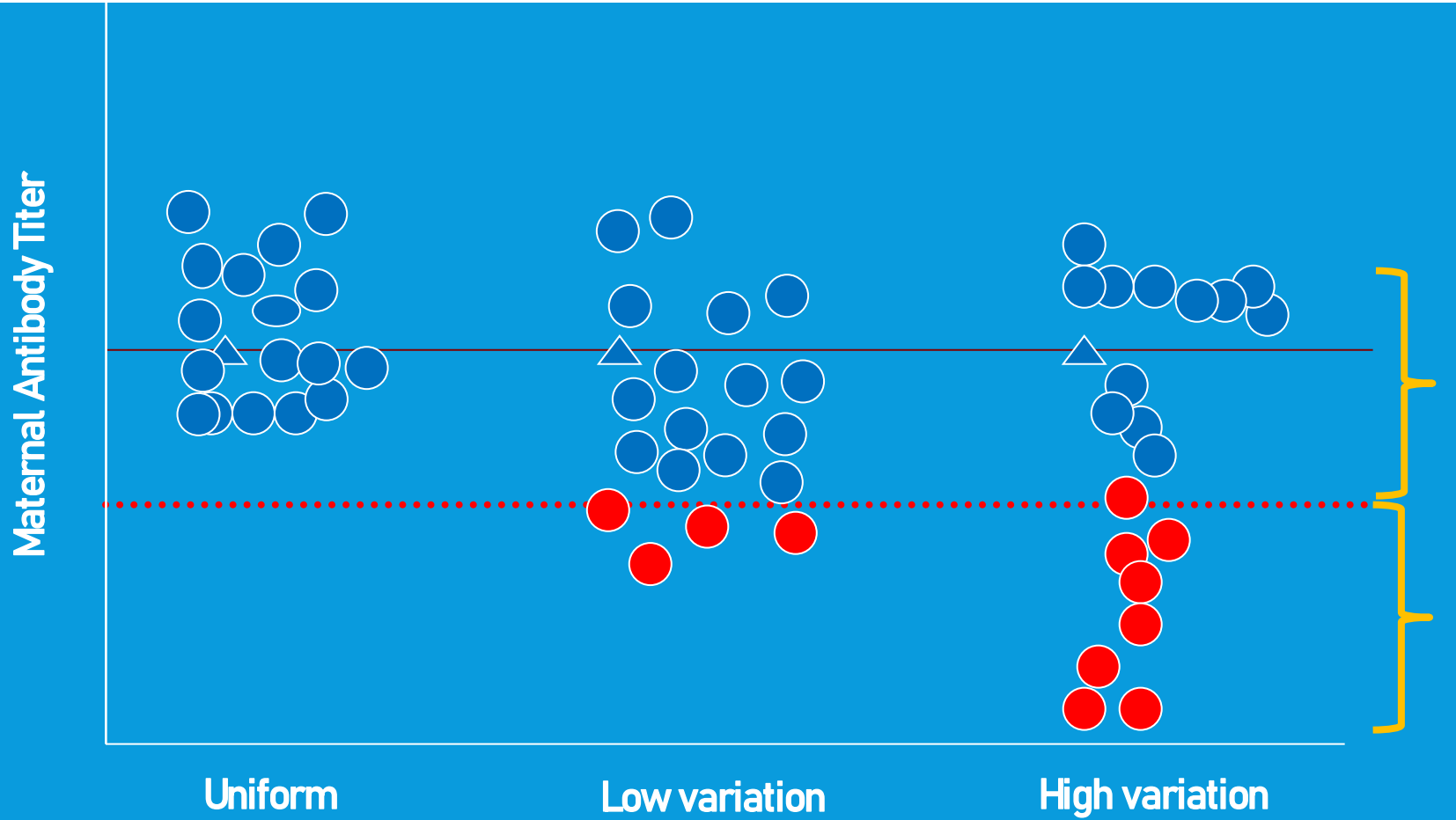
In-ovo vaccine delivered into the amniotic cavity with an accuracy of >95% and the uptake in embryo via Oral, Cloacal and respiratory route



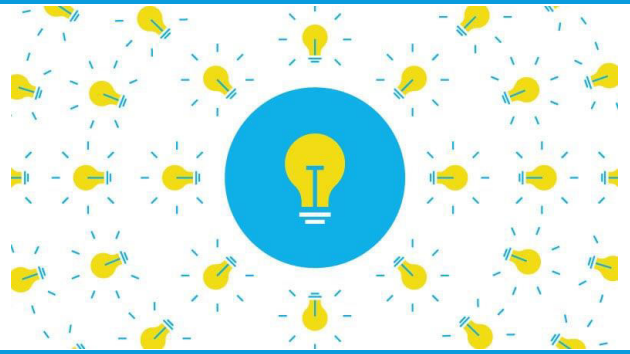
Enhanced macrophage response, increased NK cells activity, secretion of pro-inflammatory mediators, and increased production of an innate antiviral molecule, nitric oxide using TLR ligands delivered *in-ovo*

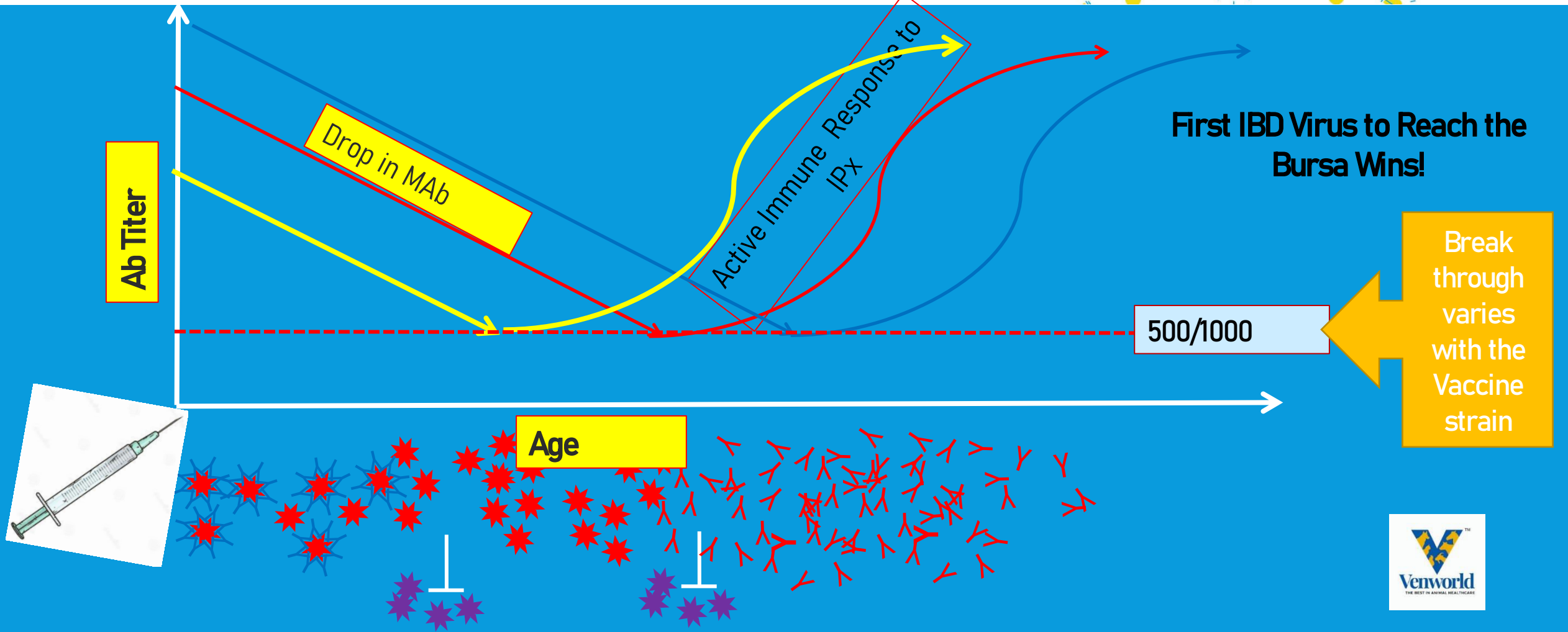
VARIATION IN MATERNAL ANTIBODY STATUS: DEPENDING UPON THE IMMUNE STATUS AND AGE OF BREEDERS





CONCEPT OF IMMUNE COMPLEX VACCINE





VACCINATION ERRORS

IN-OVO VACCINATION DELIVERY ERRORS

Vaccines will behave differently depending on the different compartments of delivery

Extra embryonic

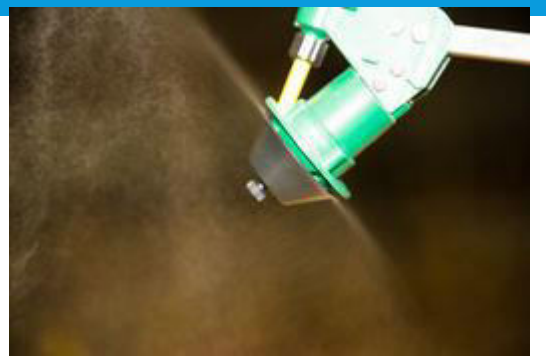
Accidental injection

Optimal timing for vaccination:

- Intra-embryo deposition at 18.5 to 19 days (12 Hours).

- Errors:
  - High percentage of allantoic deposition at 17.5 days of incubation,
  - Especially in the group containing large eggs from old broiler flocks and
  - Small embryos.

SPRAY VACCINATION



Chicks:

- Poor quality chicks
- Poor uniformity of MAb (ND, IB) - MG and MS status
- Post-vaccination reaction
- Immunosuppression

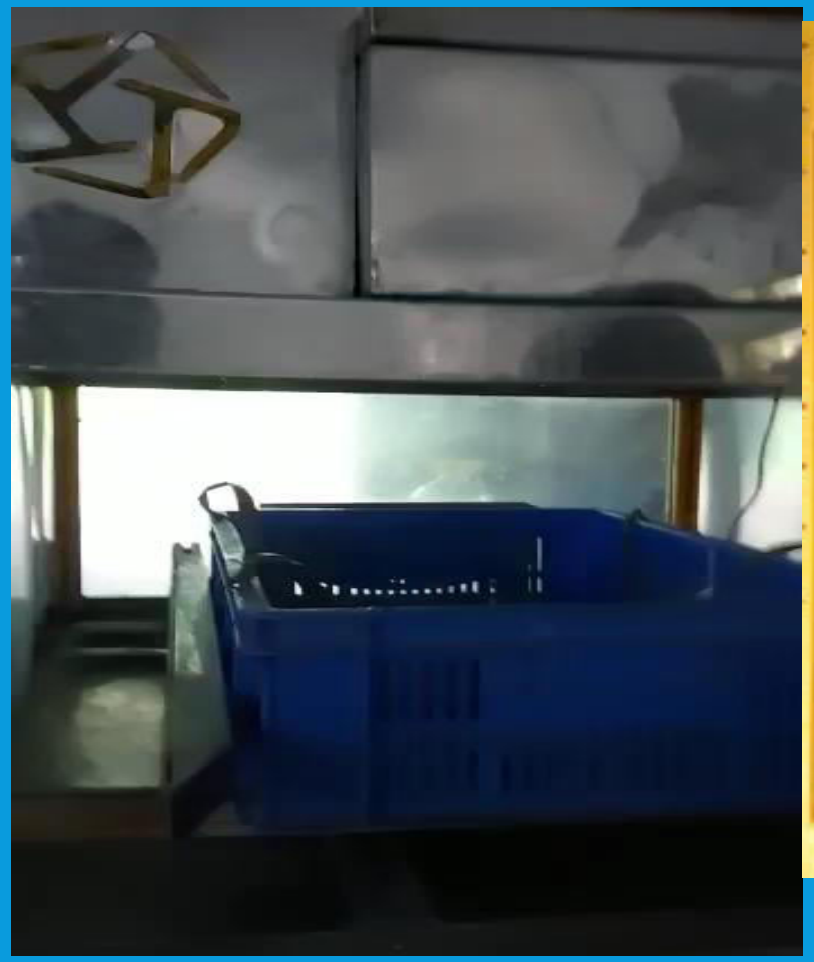
Vaccination

- Poor vaccination technique
- Inadequate vaccine dosage
- Droplet size (Average 50 - 80 µ) and volume

Inadequate environment and Poor management

- Rolling reactions (10-15 days)

ERRORS IN SPRAY VACCINATION



Consequences:

Airsacculitis

Dyspnoea

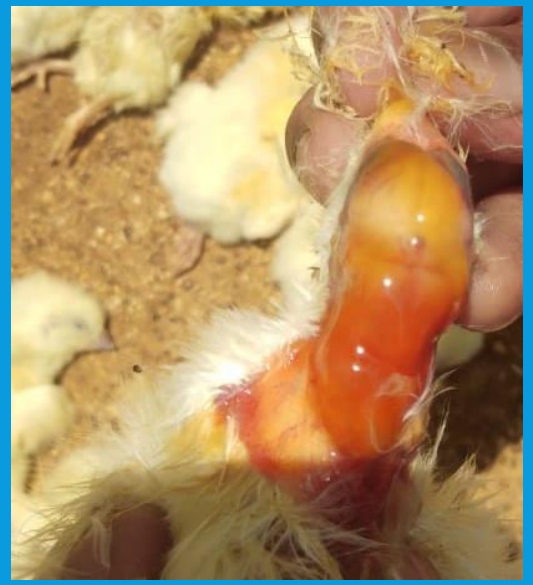
Increased mortality

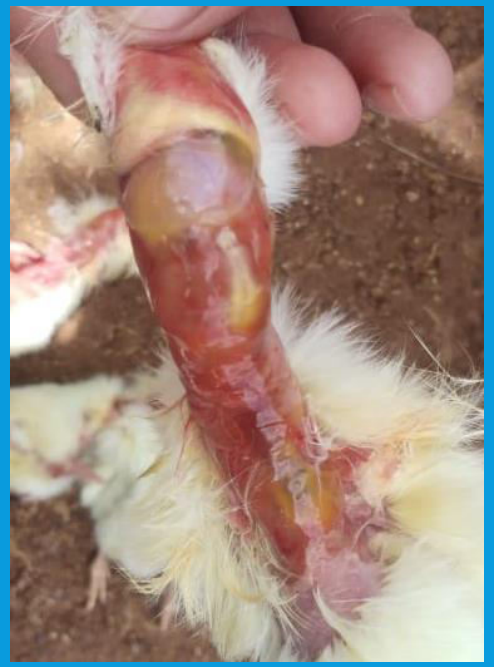
Poor performance

Condemnations at slaughter

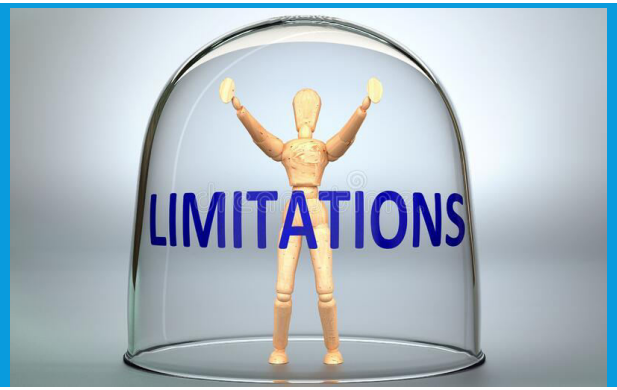
SUBCUTANEOUS VACCINATION

ERRORS IN SUBCUTANEOUS VACCINATION

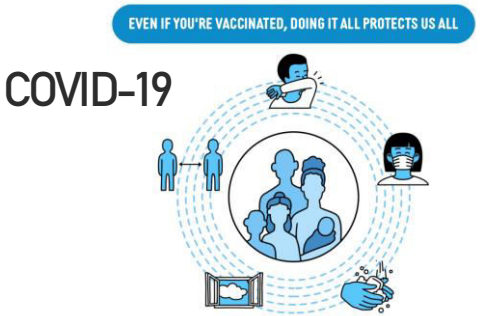




LIMITATIONS



VARIABLE EFFICACIES OF VACCINES



- Recombinant HVT-ILT vaccine confers protection against respiratory clinical signs, but not against viral shedding.
- HVT and fowlpox-vectored AI (H5) vaccines : no efficacy data available for these two hatchery vaccines.

No studies in India

HVT-vectored ND vaccine: when delivered *in-ovo* or day 1 posthatch requires 4 weeks to elicit full protection and 3 weeks to elicit partial protection.

HVT-vectored IBDV vaccine or injection of live attenuated IBD vaccine are unable to prevent disease caused by a vvIBD infected early stage of life.

Altogether, live and live attenuated vaccines are more efficacious as hatchery vaccines.

INDIAN PERSPECTIVE

Adaptation in India compared to the Western World

- Low early challenges as Litter is changed in Broilers after every batch
- Early culling by 35-42 days: No Marek's Vaccination in Broilers.
- Live bird Marketing- Process rejections
- Limited IB challenges in broilers?
- Limited availability of In-house *In-ovo* vaccines

Indigenous Vaccination Protocols targeting virulent strains endemic in India

- Velogenic Newcastle disease (GXIII): Live + Killed combination
- Very virulent IBD: Intermediate Plus vaccines
- IBH: Serotype 4 & 11 killed vaccine
- IBV : Live or Live + Killed (GI-24 lineage)
- LPAI: Killed

FUTURE

- Adapt Vaccines strains suitable for disease challenges in our Country.
- Vaccination procedures accommodating both Live and Killed vaccines.
  - Automated subcutaneous vaccinators
- Explore usage of In-Ovo embryo feeding
  - ✓ ED-12 : Prebiotics, Synbiotics, Betaine
  - ✓ ED14 : Carbohydrates
  - ✓ ED-18 : Probiotics, Vitamin-C, D, amino acids etc.

HAPPY INDEPENDENCE DAY

THANKS