Plenary Technical Webinar:

Role of Maternal Derived Antibody

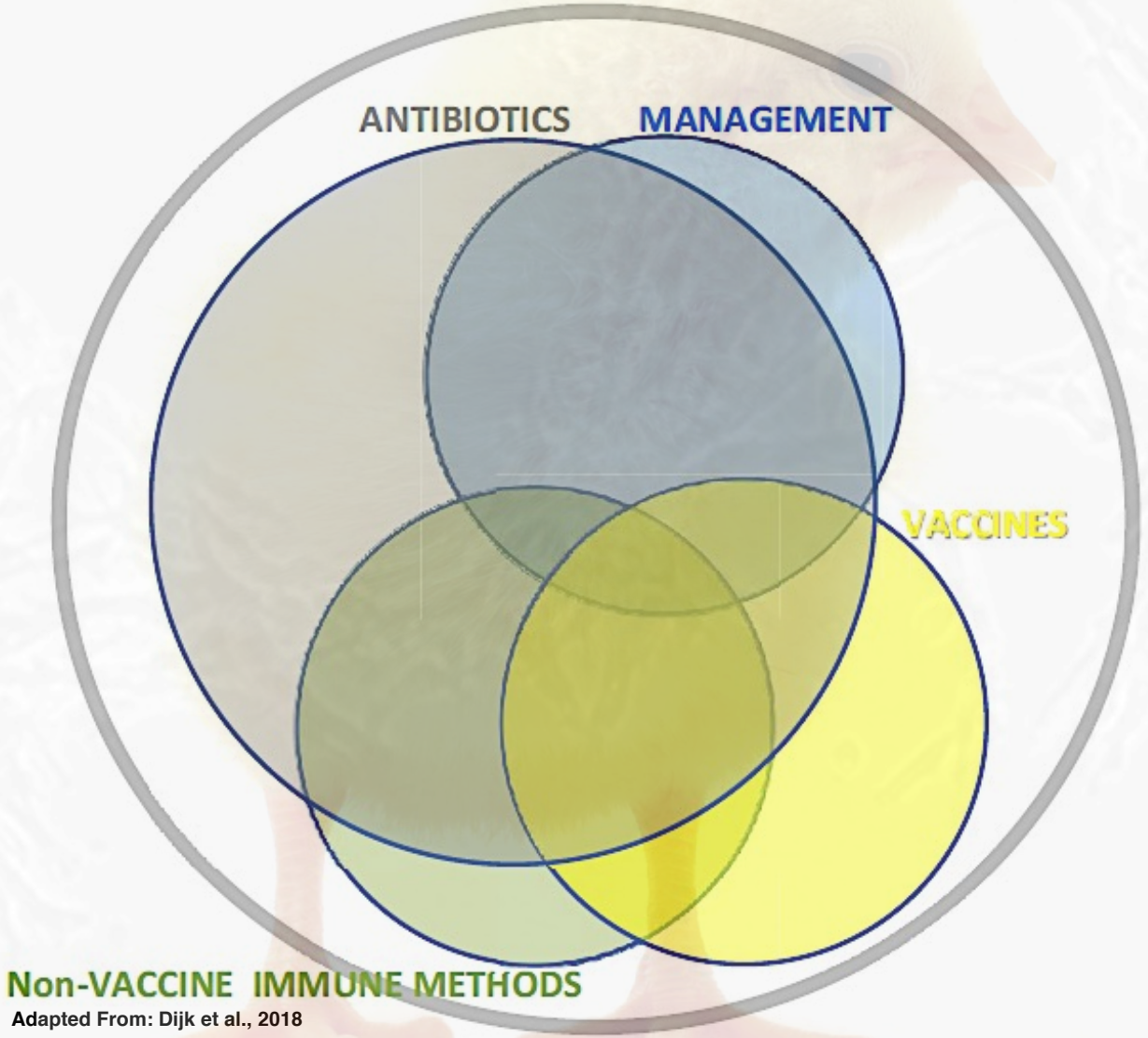
In The Early Life of Chicks

Prepared for:

Poultry TechniClass Series #1

Jakarta, July 24th 2021

Tools for Handling Infectious Diseases



Adapted From: Dijk et al., 2018

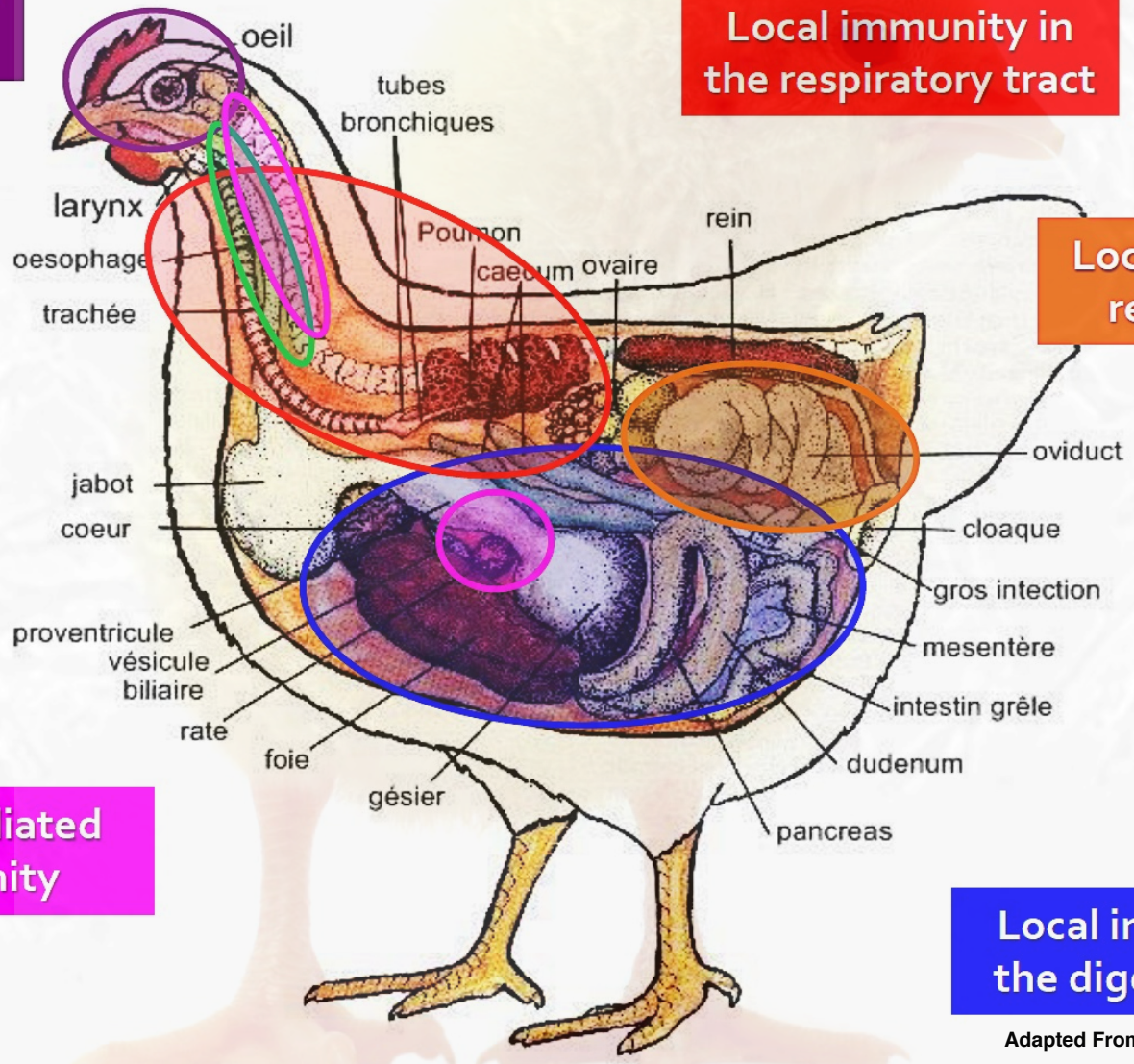
Avian Immunology: Systemic & Local Immunity

Local immunity in the head

Local immunity in the respiratory tract

Local immunity in the reproductive tract

Humoral immunity

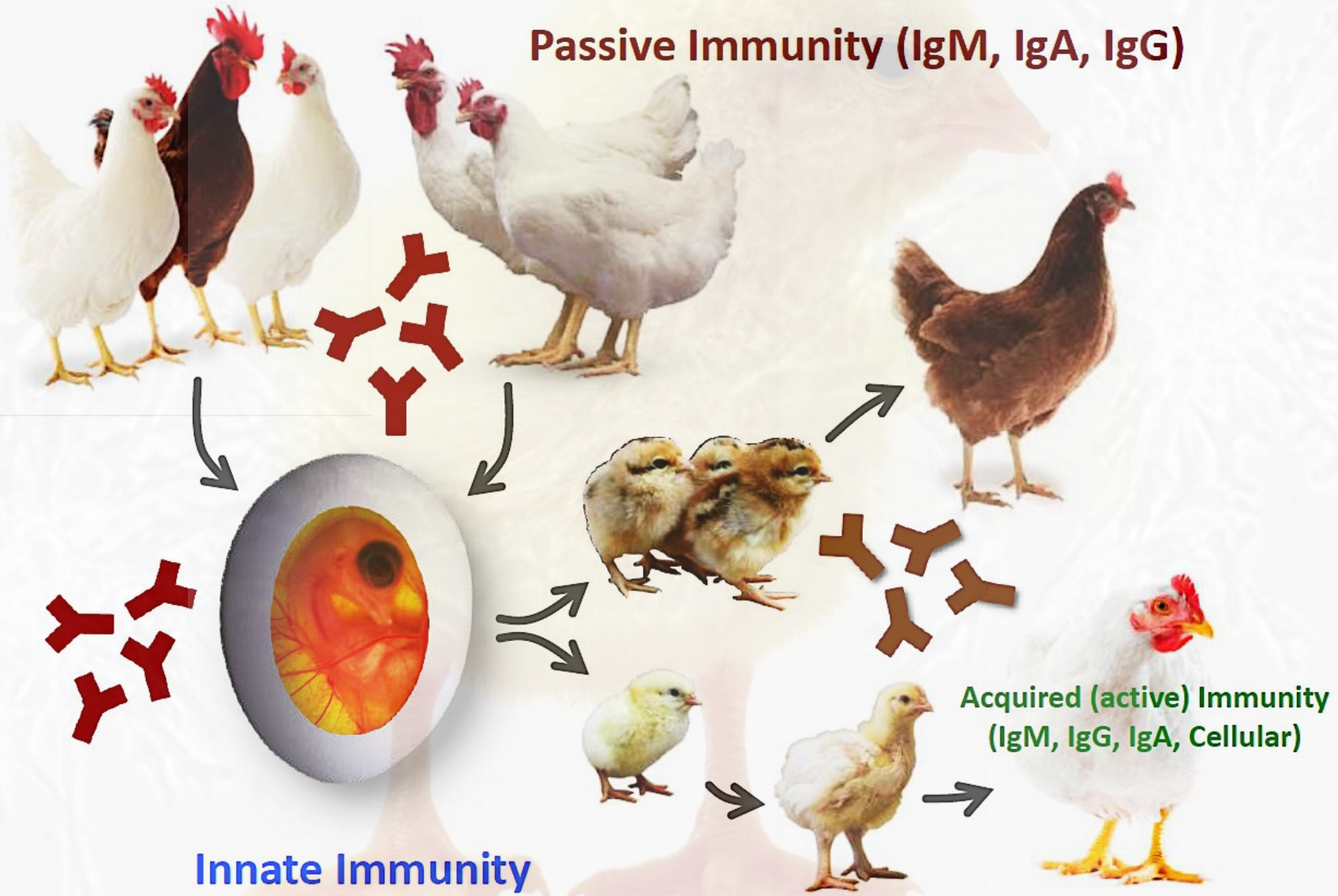


Cell-mediated immunity

Local immunity in the digestive tract

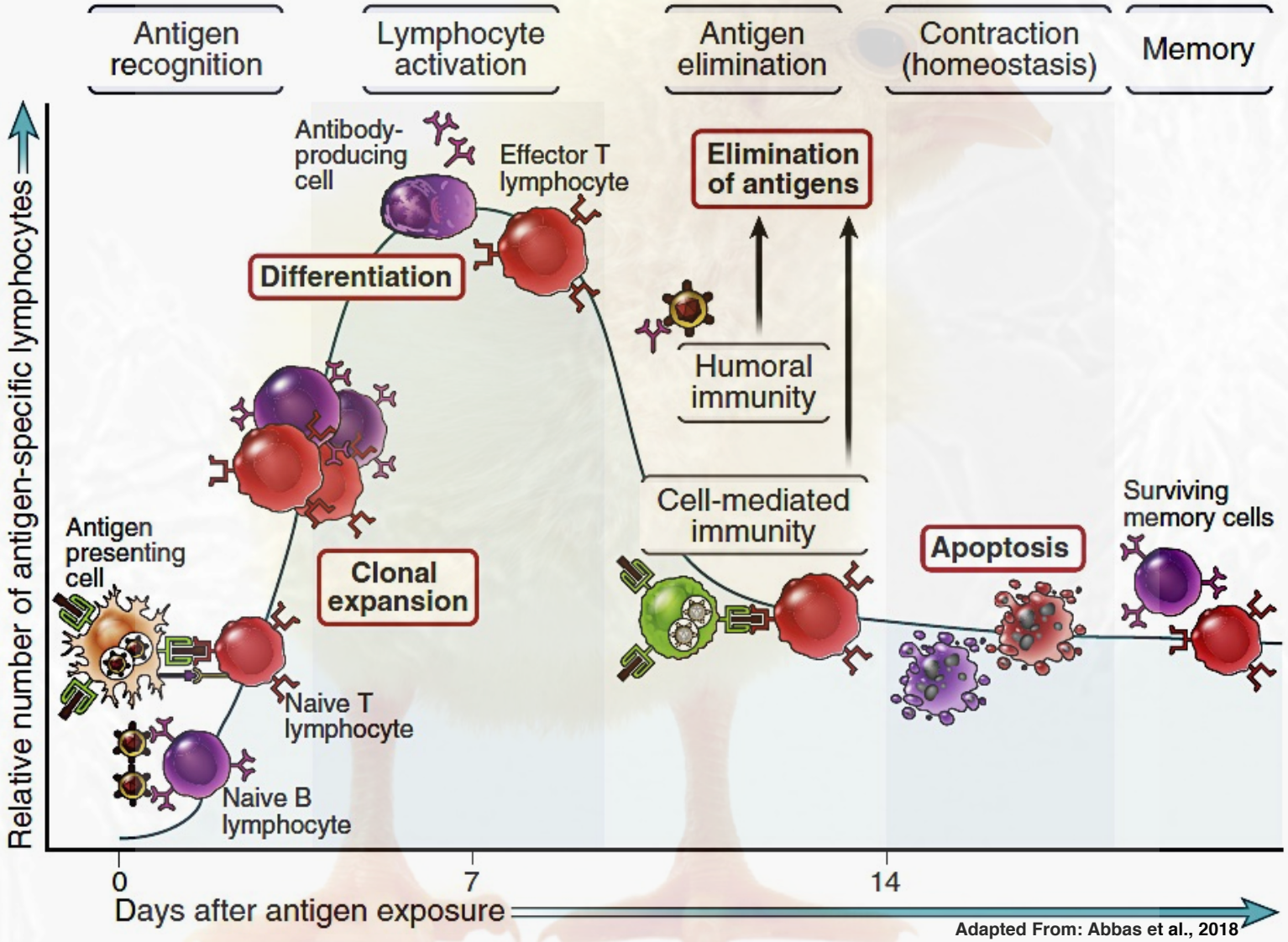
Adapted From: Rauw et al., 2016

Avian Immunology: Innate & Adaptive Immunity

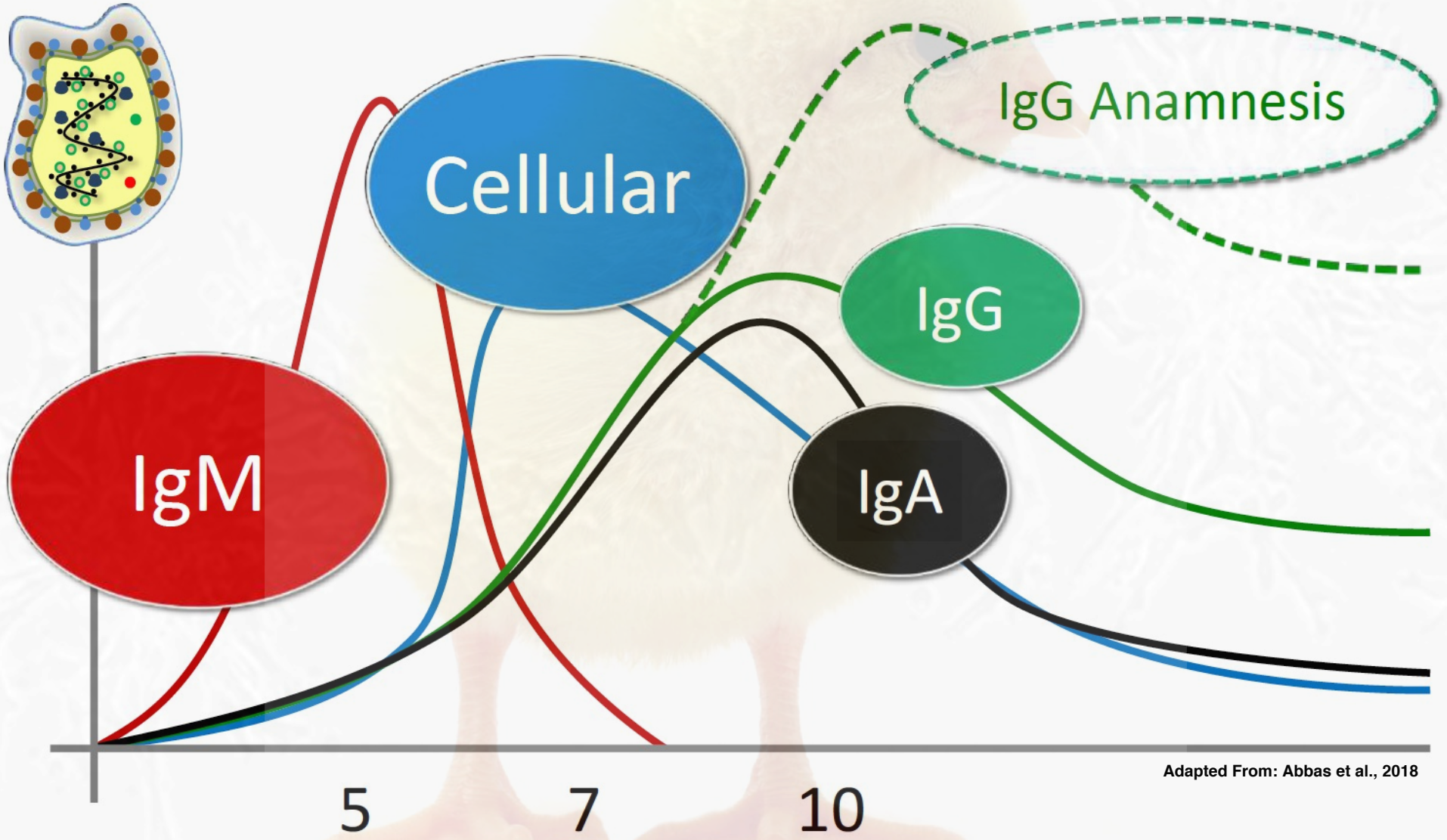


Adapted From: Abbas et al., 2018

Adaptive Immune Responses

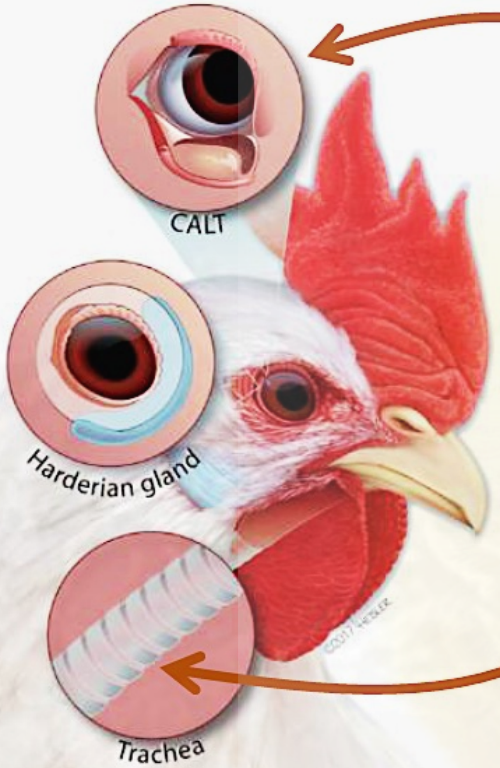


Humoral Immune Responses



Adapted From: Abbas et al., 2018

Mucosal (Local) Immunology



↑ICP4 6h P.I.

↓ 6-24 Hours IFN Blocked

↑2-3 Days IFN

↑2-3 Days ISGs

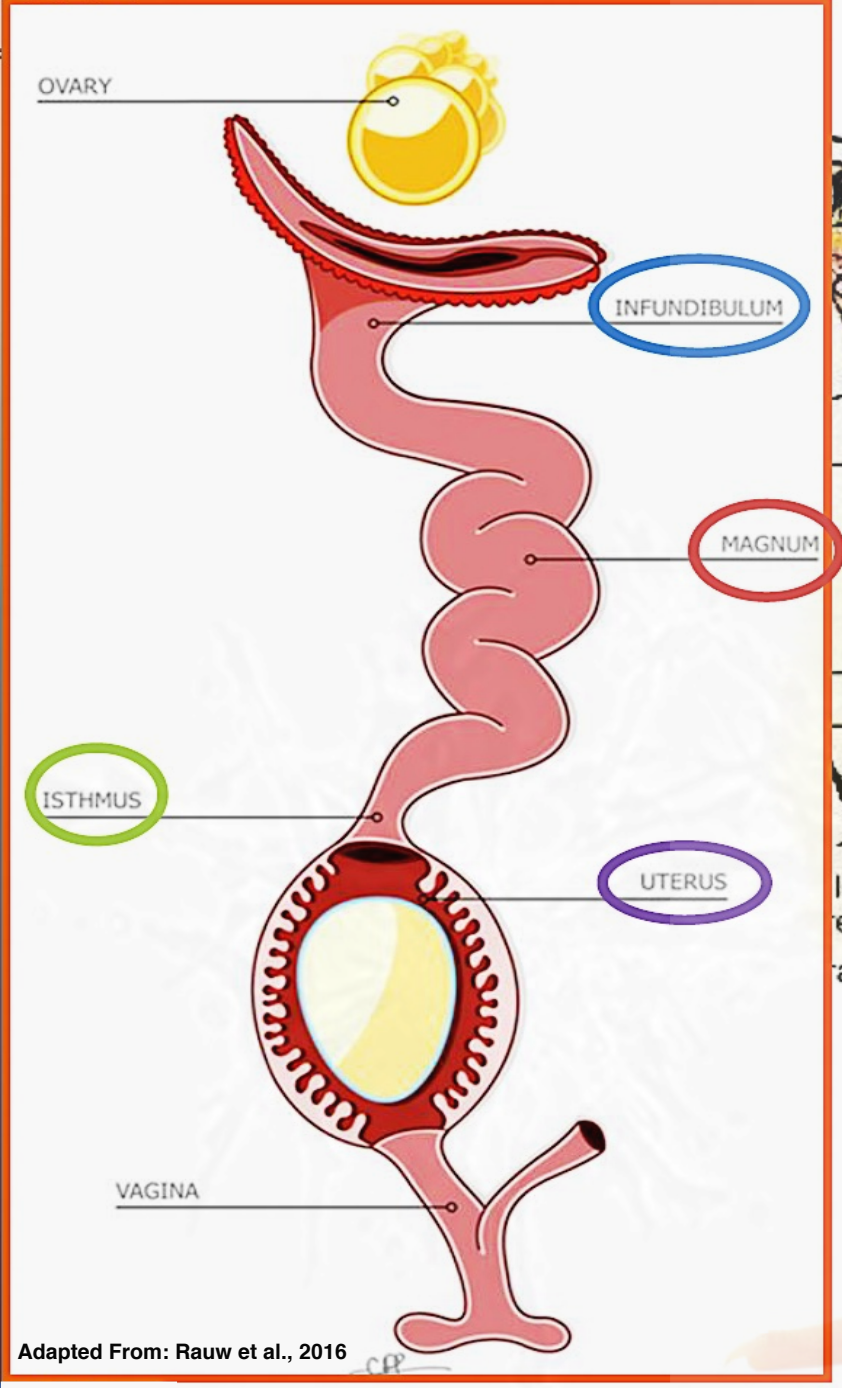
↑3-5 Days Inflammatory Cytokines

↑10 Days Cellular Immunity (Th1)

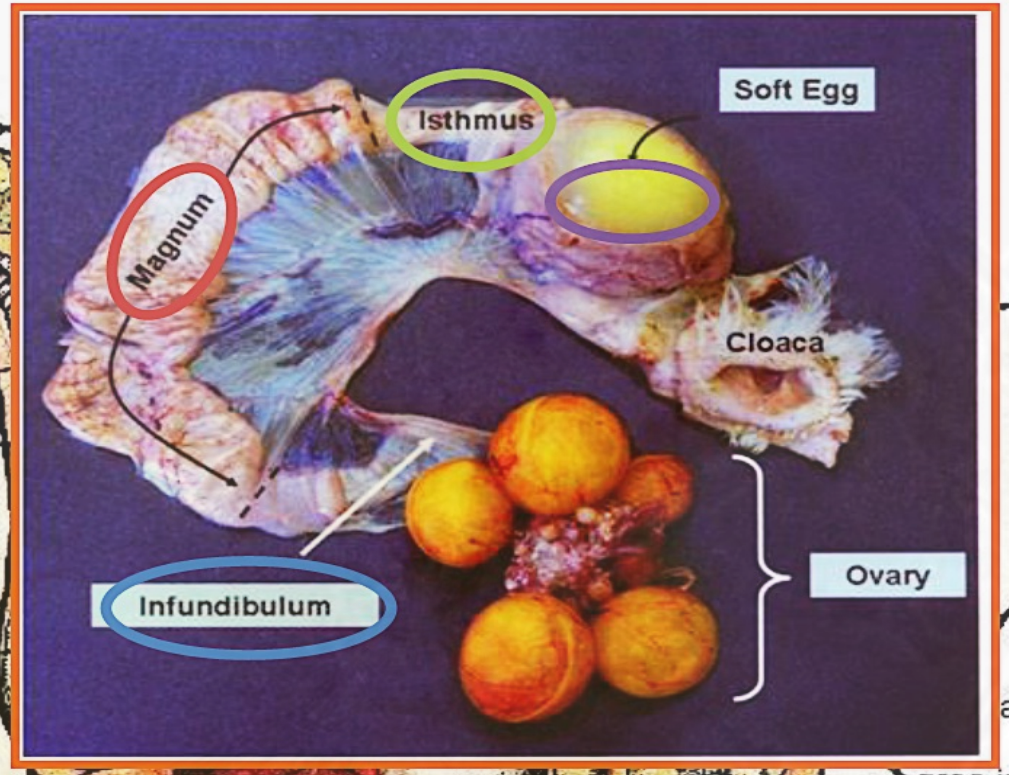
↑9-11 Days Humoral Immunity (Th2)

Adapted From: Kaspers et al., 2016

Local immunity in the reproductive tract



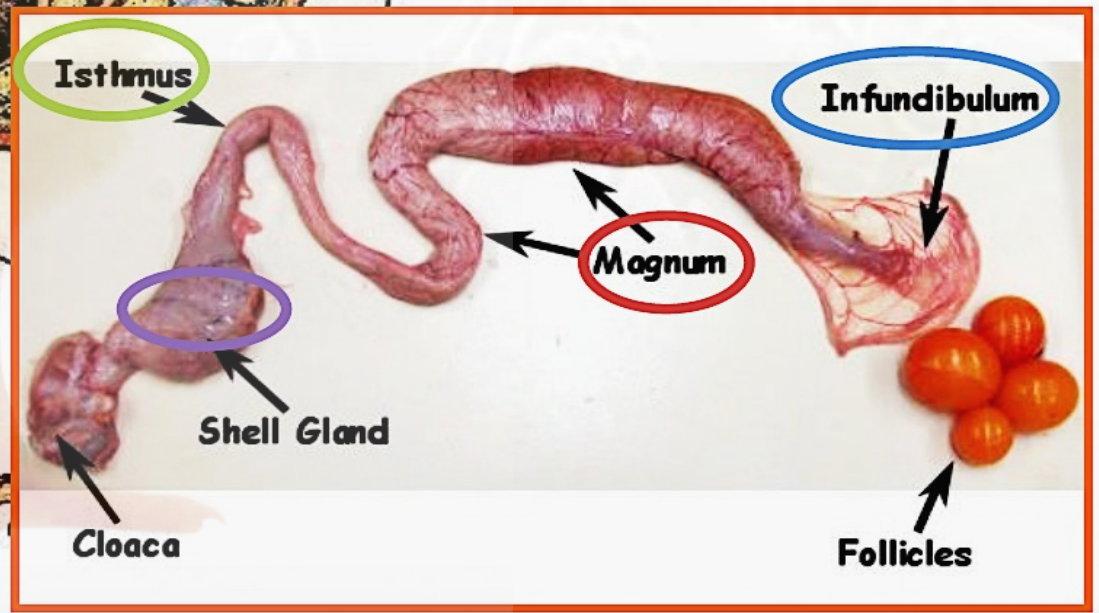
Adapted From: Rauw et al., 2016



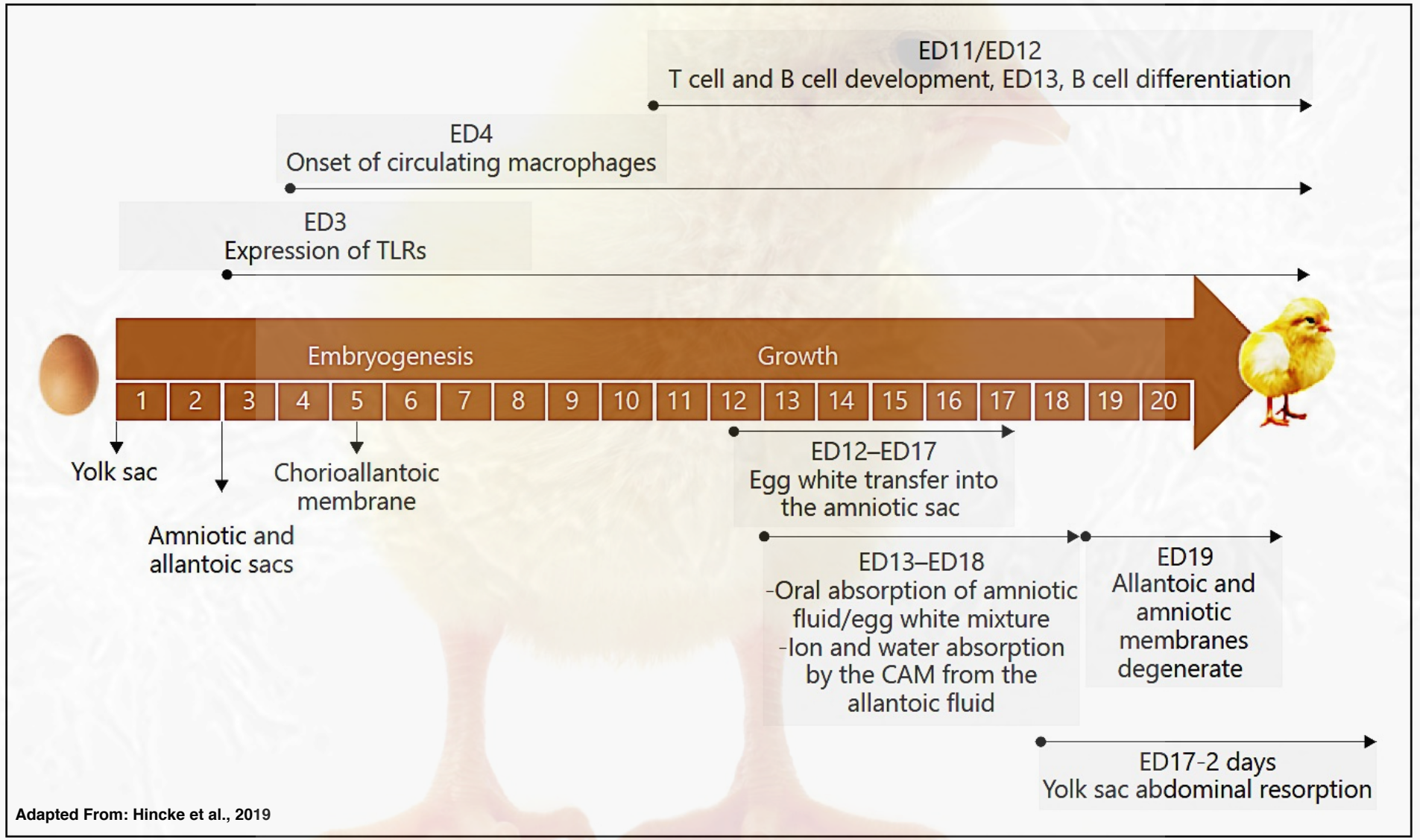
oviduct

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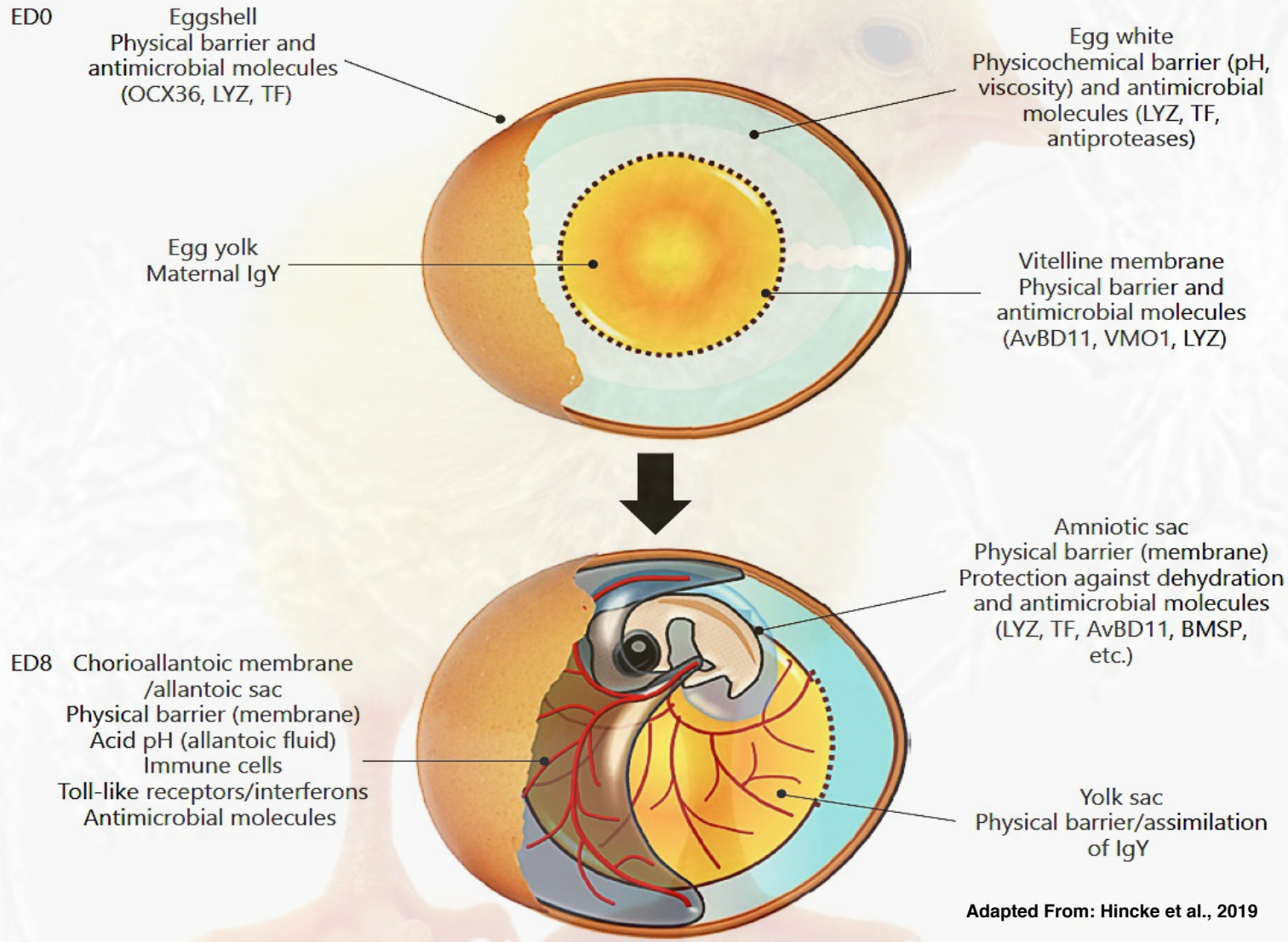


The Evolution of Innate & Adaptive Immunity



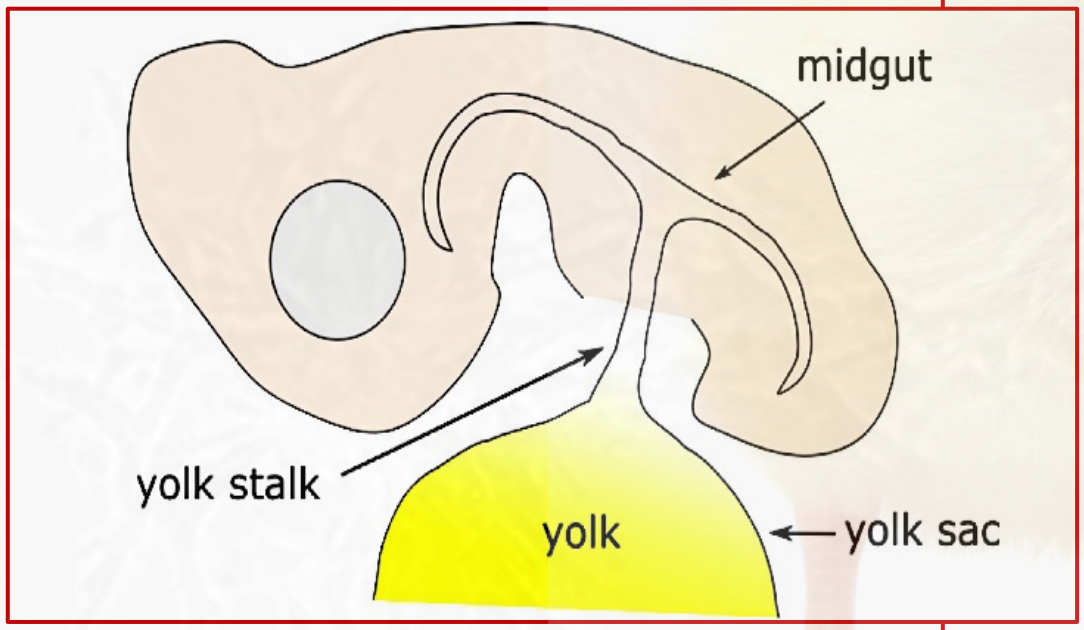
Adapted From: Hincke et al., 2019

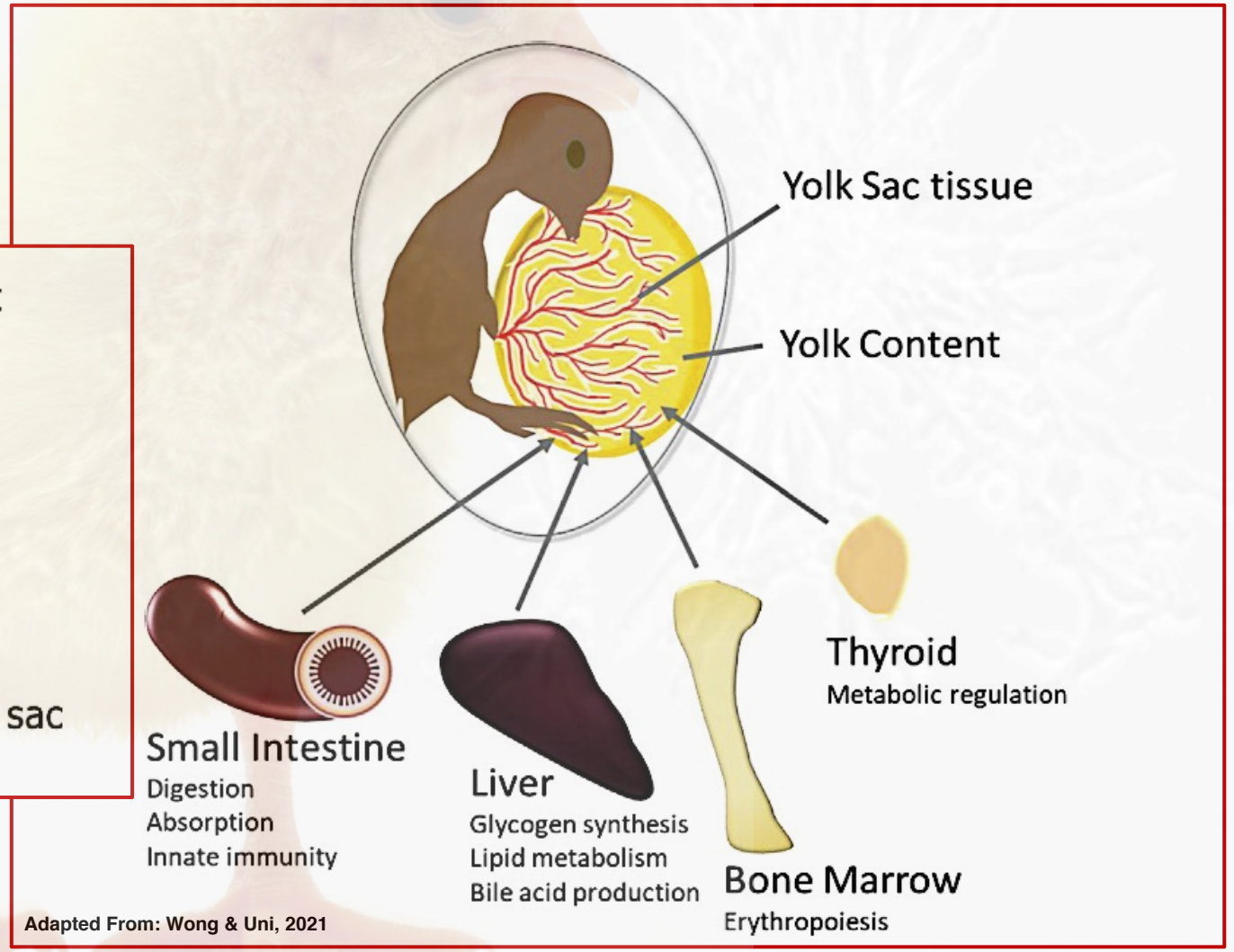
Chicken Embryonic Immune Responses



Adapted From: Hincke et al., 2019

Yolk Sac Tissue: Multifunctional Organ

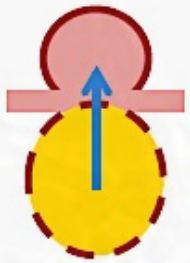


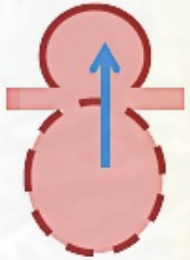


Transfer of Maternal Ig to Offspring

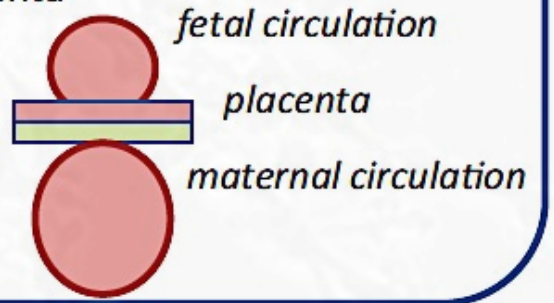
Fetal stage – mother to embryo immunoglobulin transport

FISH & BIRDS	PRIMATES & RODENTS	DOG, CAT, MINK	RUMINANTS, PIGS, HORSES
Active transport /yolk sac	Active transport Hemochorial placenta	Limited transport Endotheliochorial placenta	No transport Epitheliochorial placenta







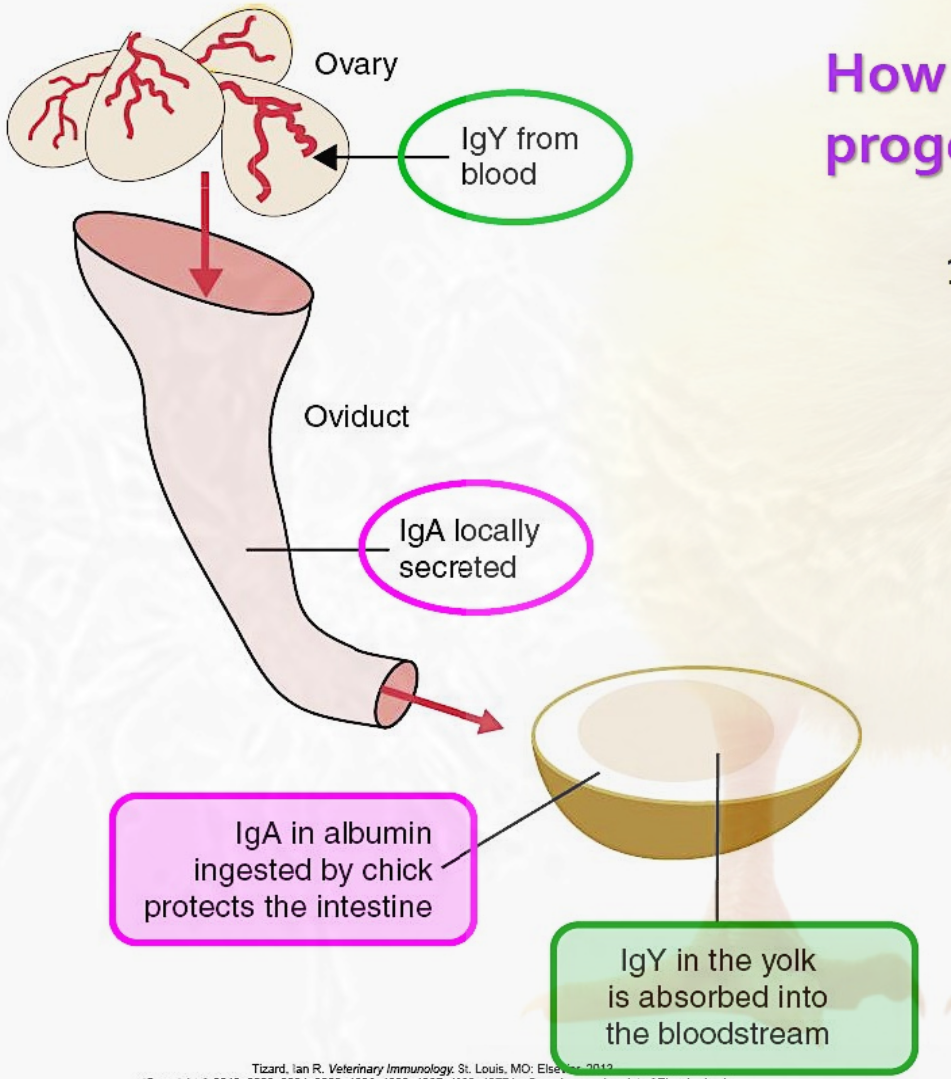


Neonatal stage – circulating immunoglobulins

IgM (fish) **IgY** (birds)	**IgG**	**IgG** (low levels)	No circulating Ig's
Gut uptake: (open gut)			
No	**No**	**Yes** (< 36 h after birth)	**Yes** (< 24 h after birth)

Adapted From: Dijk et al., 2018

- Maternal Derived Antibodies (**MDA**) or Passive Immunity is the naturally transfer of antibodies from immunized breeder hens to the progeny through the egg
- To protect young chicks against pathogens during a period (1-2 weeks and less than 4 weeks) where their immune system is not fully mature.



Tizard, Ian R. *Veterinary Immunology*. St. Louis, MO: Elsevier, 2013.
(Copyright © 2013, 2009, 2004, 2000, 1996, 1992, 1987, 1982, 1977 by Saunders, an imprint of Elsevier Inc.)

How MDA are transferred from the hen to the progeny ?

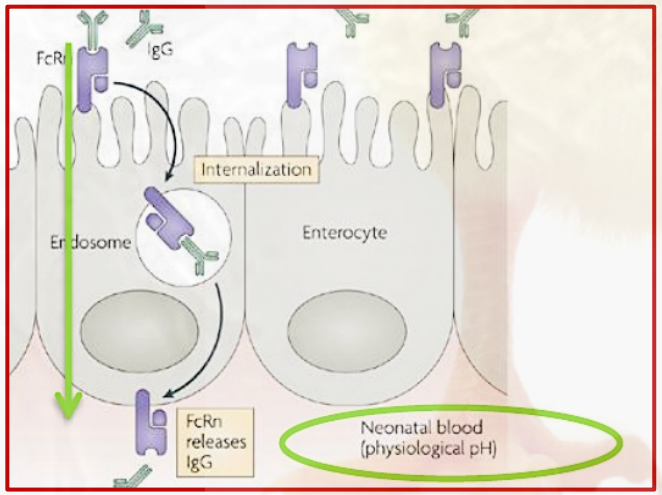
1. MDA transfer from the hen to the egg
   - **IgG(Y)** are secreted by the chicken ovarian into the developing ova or egg yolk
   - **IgA and IgM** are produced locally in the magnum in the oviduct and transfer to the albumen

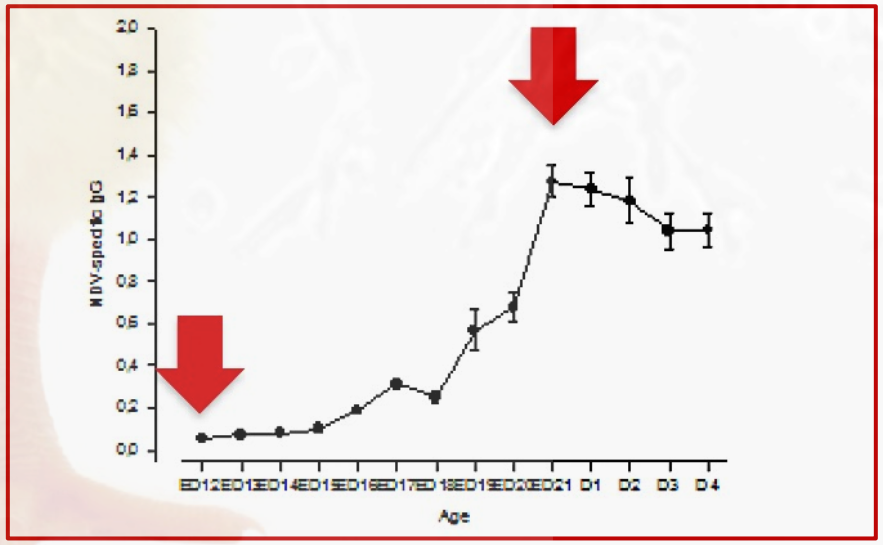


Adapted From: Rauw et al., 2016

How MDA are transferred from the hen to the progeny ?

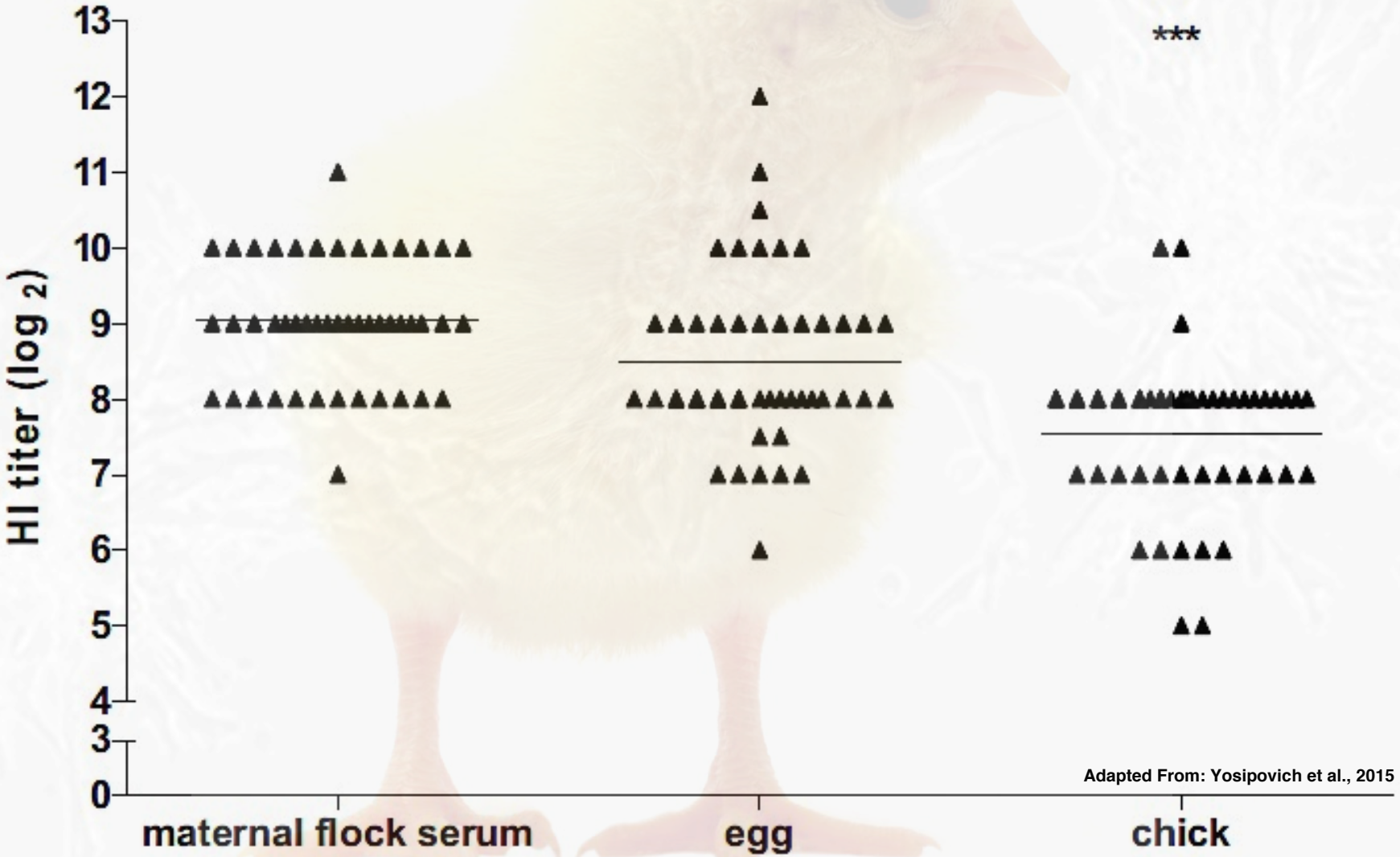
1. MDA transfer from the hen to the egg
2. MDA transfer from the egg to the progeny
   - **IgG(Y)** :
     - Are transferred from the egg yolk to the offspring via the embryonnic circulation
     - Only IgGs are able to cross the intestinal barrier through the embryonic circulation
     - The transfer starts from 7 ED and reaches its maximum rate at 17-18 ED (3 to 4 days before hatching)
   - **IgA and IgM** in albumen are ingested by chick and protect the intestine.



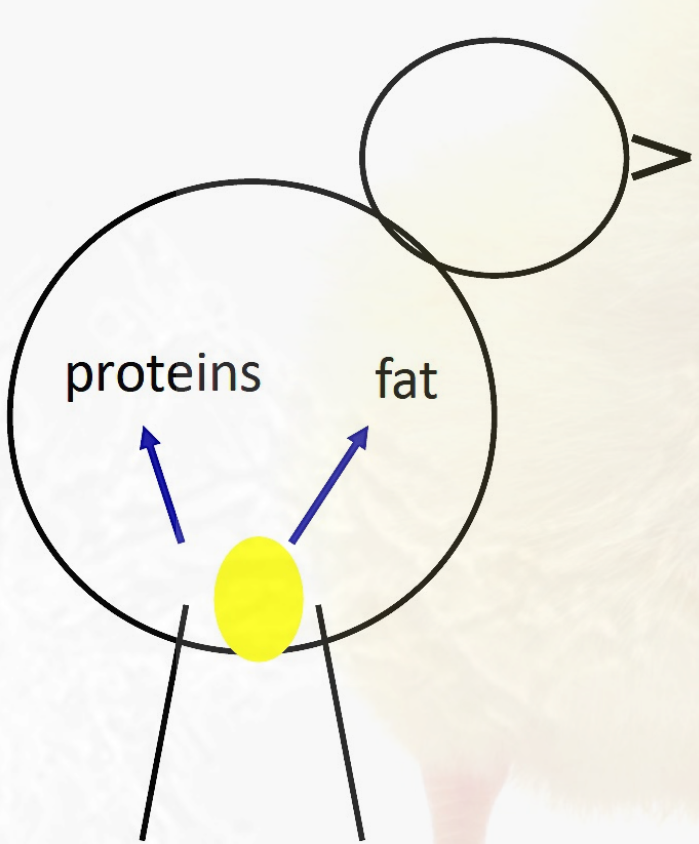


Adapted From: Rauw et al., 2016

ND IgY: Maternal - HE - DOC Serum



The Importance of Early Feeding



feed

With feed:

Fat + feed gives energy

Protein available for development

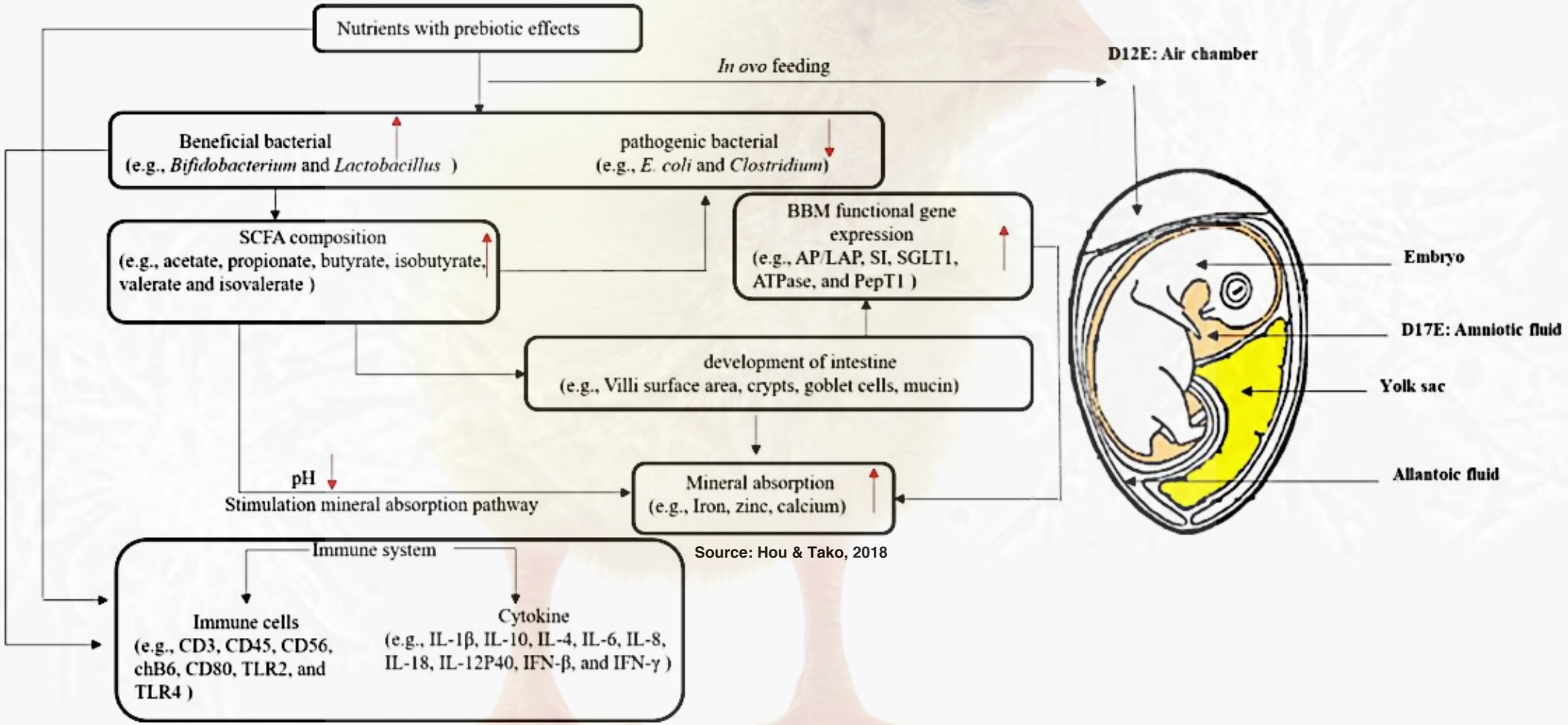
Without feed:

Fat + protein gives energy

No protein for development

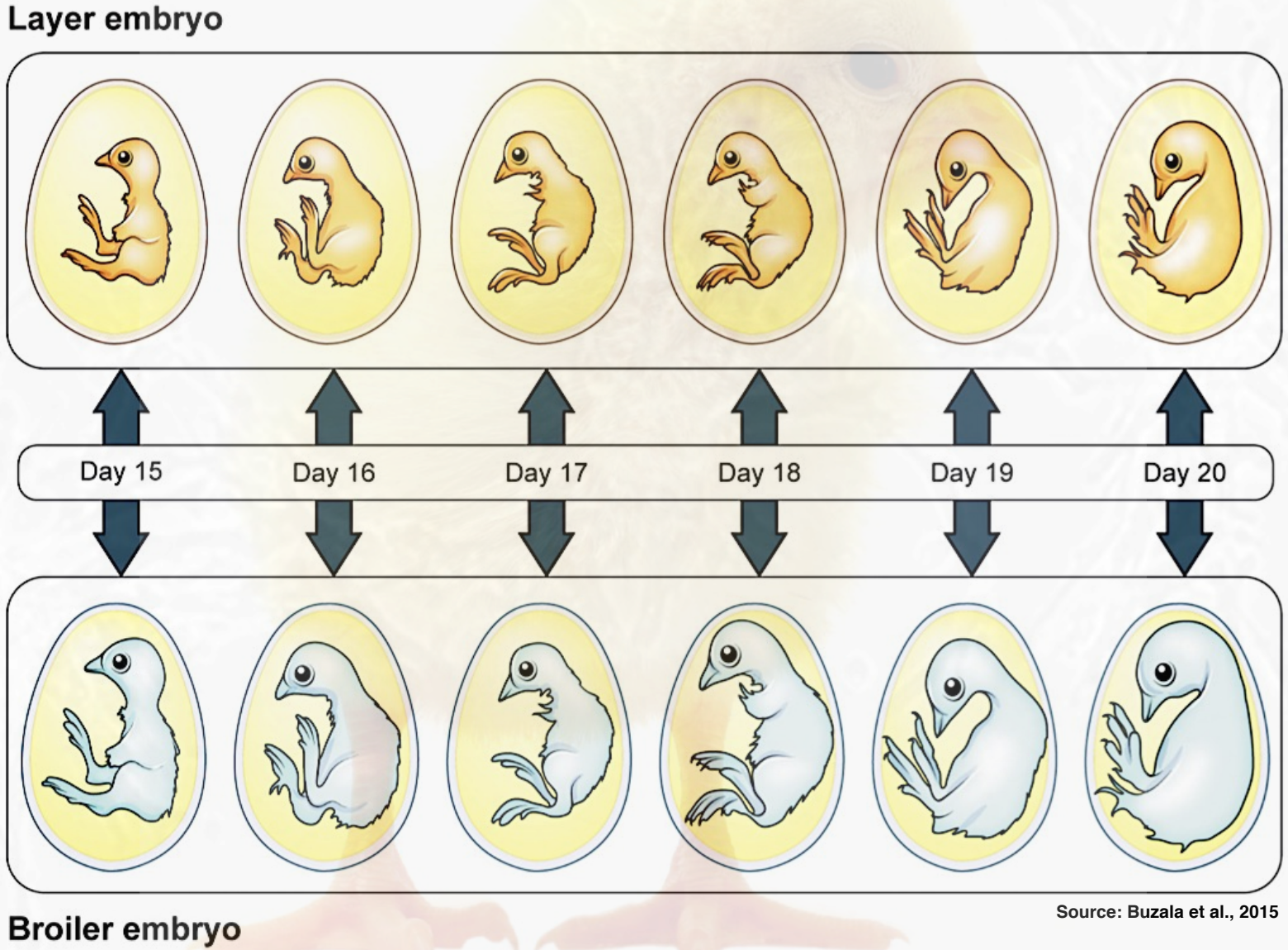
Birds need carbohydrates (feed) so protein from the yolk will be available for development

In Ovo Feeding & Immune System Development



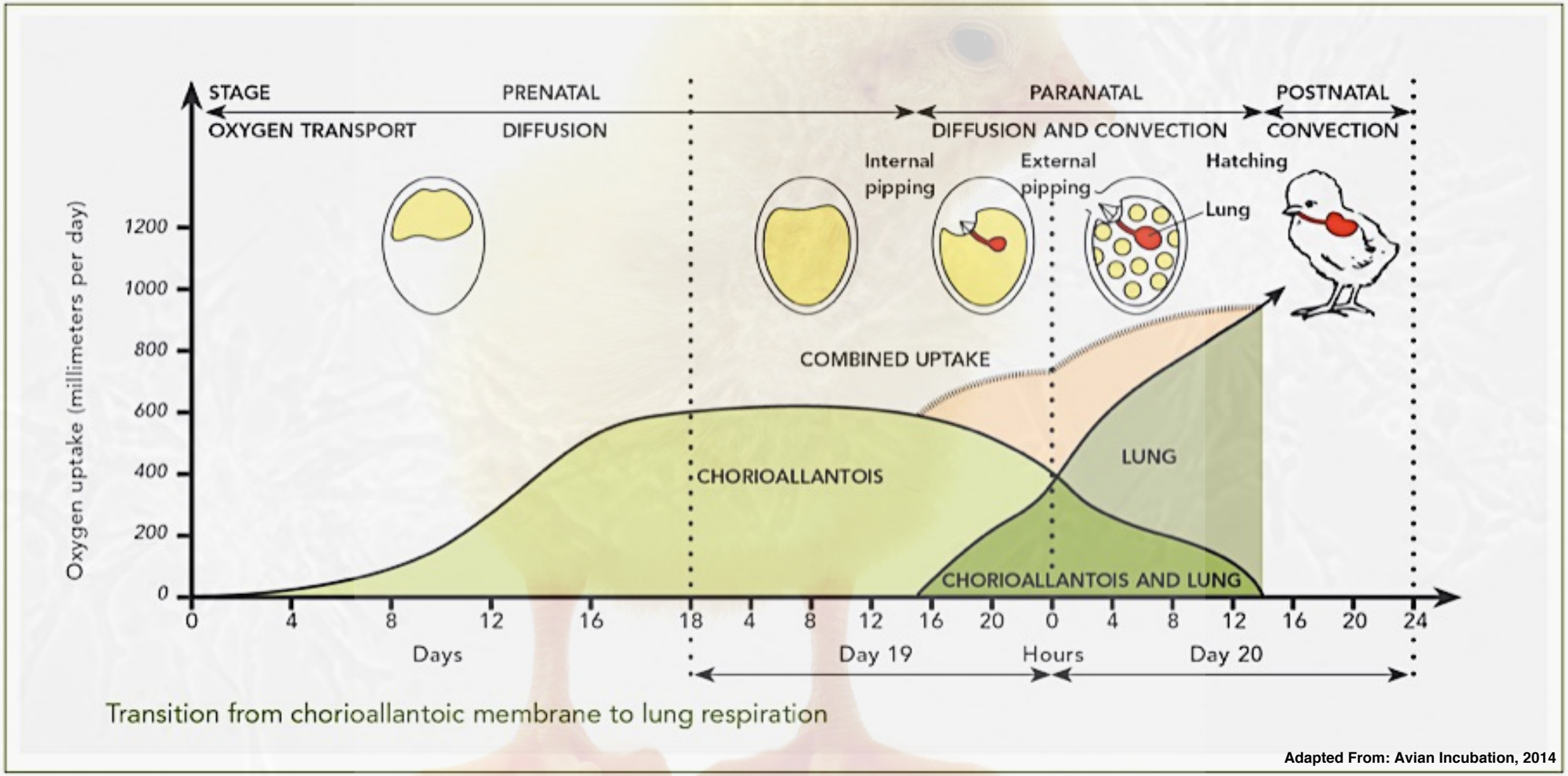
Source: Hou & Tako, 2018

Embryogenesis: Layer vs Broiler Type



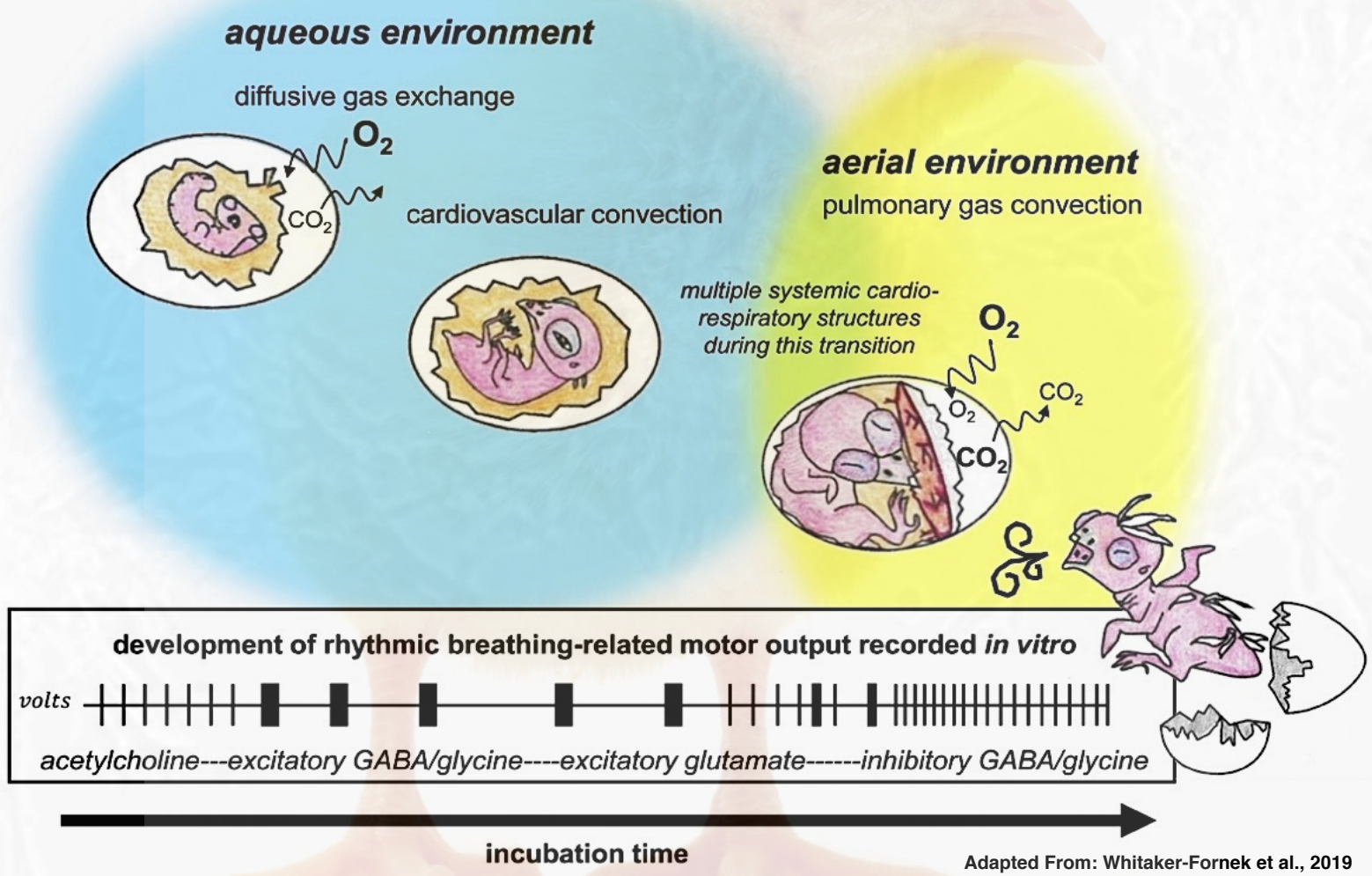
Source: Buzala et al., 2015

Respiratory Evolution of a Chick



Adapted From: Avian Incubation, 2014

Respiratory Evolution of a Chick



Adapted From: Whitaker-Fornek et al., 2019

Hatchery Distress

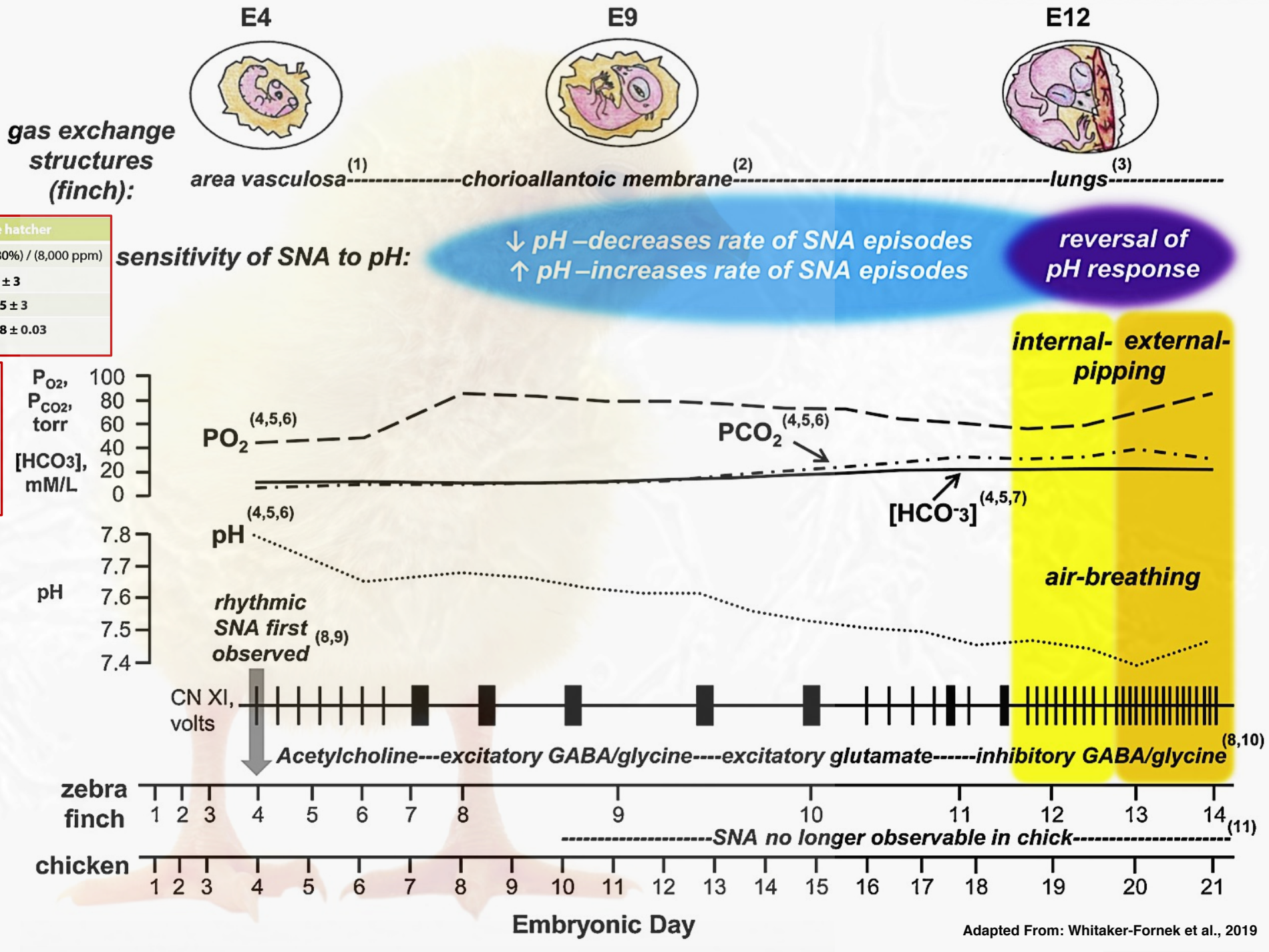
Variables	Levels of CO_2 during about 24h in the hatcher	
	(0.45%) / (4,500 ppm)	(0.80%) / (8,000 ppm)
Heterophile count	21.1 ± 5	7.5 ± 3
Lymphocyte count	78.8 ± 5	92.5 ± 3
Heterophile / Lymphocyte ratio	0.27 ± 0.07	0.08 ± 0.03

H:L ratios – what do the numbers mean?

< 0.20: low stress;

0.20 - 0.50: intermediate stress

>= 0.80: high stress



Adapted From: Whitaker-Fornek et al., 2019



THANK YOU
FOR YOUR KIND ATTENTION

