Hatchery Talks

Early embryonic mortality

Before we start …

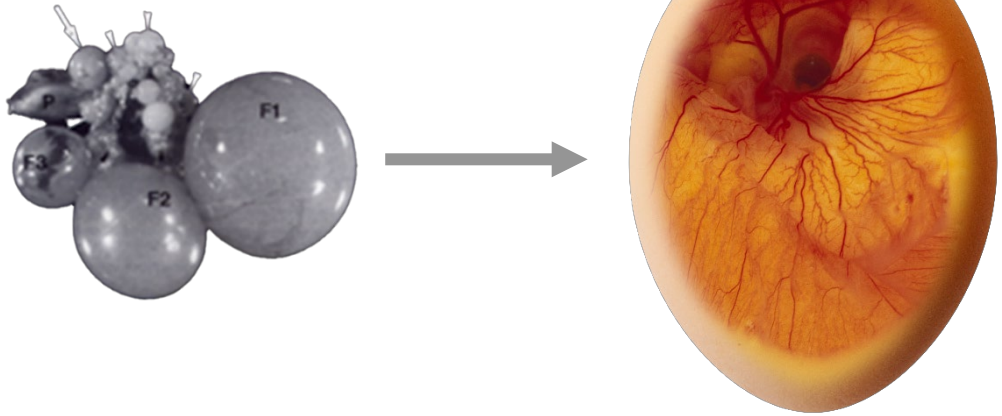
- Polls
- Questions in chat
- Webinar-replay + hand-out

Content

- **Possible reasons of early mortality during**
  - Embryonic development in the hen
  - Embryonic development after laying
  - Egg handling
  - Embryo development during first week of incubation
- **Summary**

Early embryonic mortality

From ovum to 7 days incubation.



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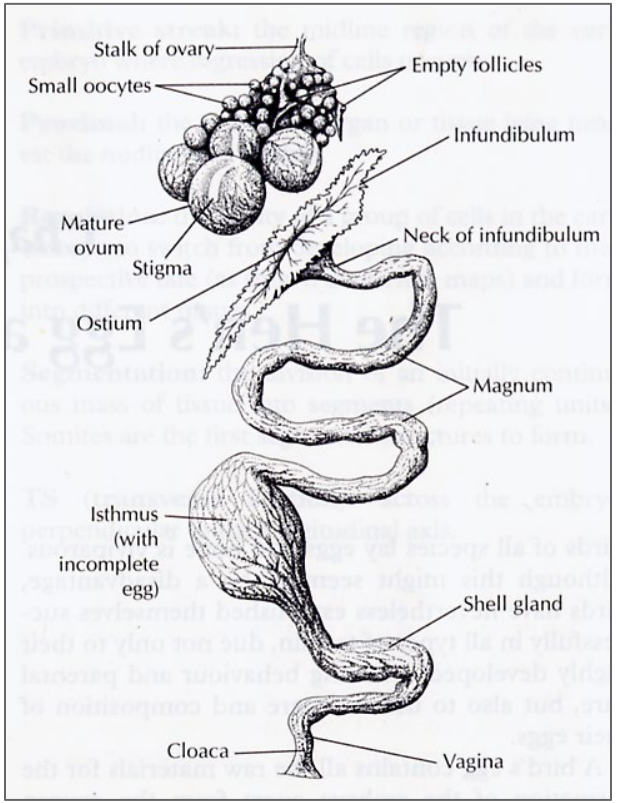
Embryonic development in the hen

Poll

Yes or No, Do you collect information about the circumstances of the eggs from the moment of laying until arrival at the hatchery?

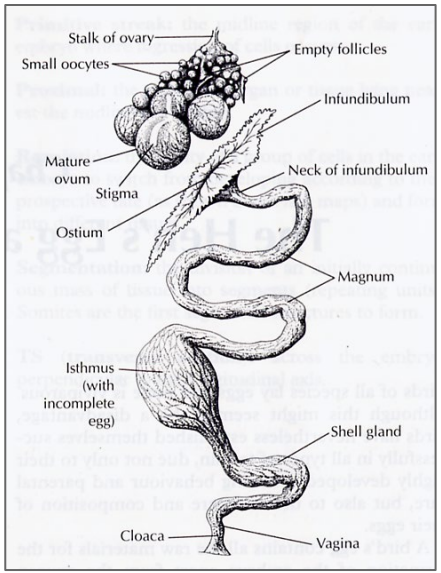
Maternal origin of basic nutrients

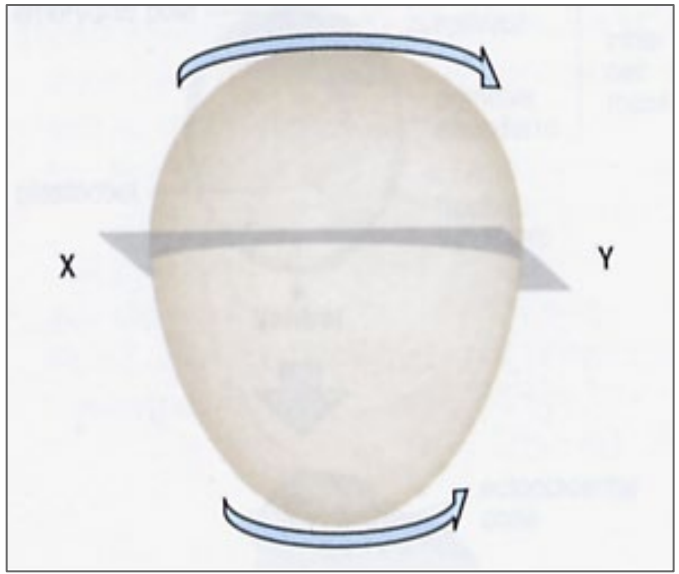
- Yolk (ovary)
- Albumen proteins (magnum)
- Shell membranes + water (isthmus)
- Shell (shell gland)



Maternal origin of basic nutrients

- First cleavage divisions start after fertilization
- Development of the head-to-tail axis during formation of the shell





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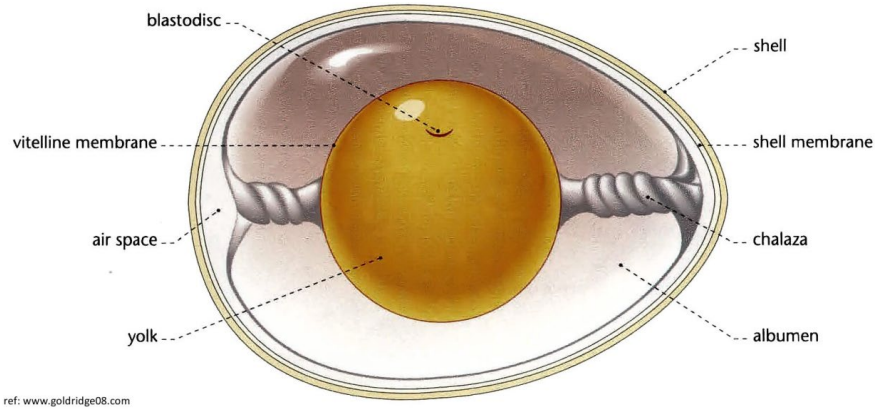
Embryonic development after laying

Adaptation period

First hours after laying (oviposition)

- Cuticle is drying
- Air cell is formed
- CO_2 diffuses out of the eggs → pH gradient
- Blastoderm continues to develop as long as internal egg temperature is > 25 °C / 77 °F



ref: www.goldridge08.com

Embryonic development after laying

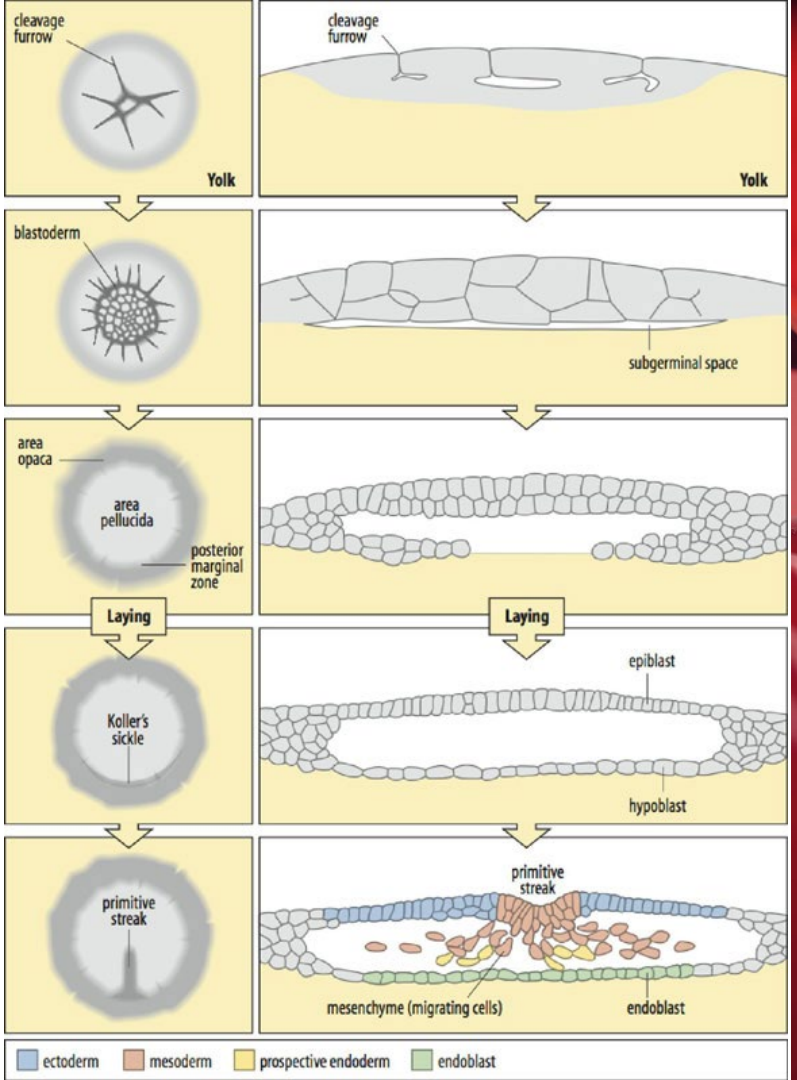
Embryonic stage

Stage IX-X: **Embryonic stage at oviposition**

(Ref; Eyal-Giladi 1976)

Stage XII-XIII: Embryonic stage after cooling to room temperature

(Ref; Eyal-Giladi 1976)



Ref: Gilbert , 2006

Optimal cooling rate

For optimal embryo development eggs have to cool down from body temperature hen (41° C/ 105.8 °F) to internal temperature of 22-25 °C / 71.6 – 77 °F during a period of 6 hours

- Too fast: under-developed embryos
- Too slow: too much advanced embryos
- In both cases reduced embryo survival in stored eggs!

Optimal cooling rate

Cooling depends on multiple factors:

- Nest type
- External temperature (temperature + air flow!)
- Frequency of egg collection
- Type of egg tray



Diapause

- Temporary arrested development
- Storage resistant phase
- When egg content is below 22 °C
- Optimal storage stages are XII-XIII.
  - Slower of quicker cooling down rates are influencing the embryonic stage

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Egg handling

Transport

- Conditions during (un)loading
- Temperature fluctuations in truck
- Shocks and jolts

Storage

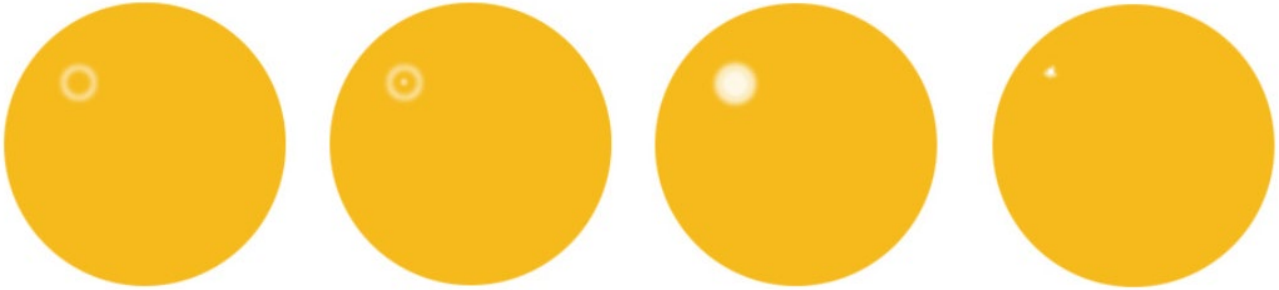
- No storage
- Temperature fluctuations
- Longer stored eggs need lower storage temperature
- Heat treatment gone wrong

Judging post-lay egg cooling and further storage conditions

Recording Form 8C: Fertility and embryo quality upon receipt

Category	Number of eggs within …	
	Sample of 10 eggs	Additional 20 eggs
Infertile		
Fertile, diameter approx. 3.5– 5 mm; doughnut-like opaque ring with translucent centre		
Fertile, embryo too small (≤ 3.5 mm); white dots in centre of opaque ring		
Fertile, embryo too big (> 5 mm)		
Fertile, abnormal embryo		

The unincubated fertile and infertile egg



Fertile

Fertile

Fertile, too far developed

Infertile

Disinfection with formaldehyde

- Duration of disinfection
- Residual fumes in setter
- Not during incubation!

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Embryonic development during incubation

Start of incubation

The temperature of the embryo influences

- **Cellular movements**
- **Rates of development**
- **Hatching time**

Embryonic development during incubation

Day 1 and 2

Sub-embryonic fluid formation is visible in the yolk

Embryonic development during incubation

Day 3 and 4

- Blood ring visible
- Eye pigmentation

Embryonic development during incubation

Day 5 – 7

- **Area vasculosa covers > 50% of the yolk sac**
- **Egg tooth appears**

Effect of storage

Embryos of 60 hours incubation

Suboptimal temperature

Too warm or too cold

- Embryonic growth decreases
- Embryo mortality increases
- Incidence of malformations increases (Christensen, 2001; Noiva et al., 2014)

Suboptimal turning

Turning frequency

- The less turning per day, the higher the early and late mortality (Oliveira et al., 2020)
- Turning angle

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Interpretating breakout results

When?

- **'Fresh' eggs**
  → Internal & embryo quality (+ fertility)

- **After 10 days of incubation**
  → true fertility and mortality pattern

- **After candling**
  → fertility and mortality pattern

- **After hatch**
  → fertility and mortality pattern; other losses

Poll

Yes or No, You examine the fertility and mortality patterns of flocks at your hatchery by either eggs.

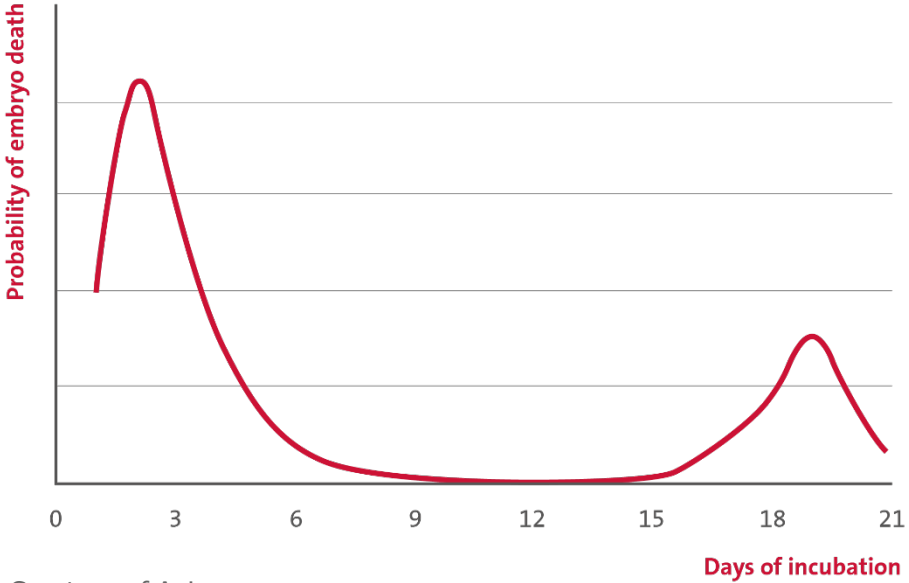
The unincubated fertile and infertile egg

Infertile

Fertile

Normal pattern of embryo loss

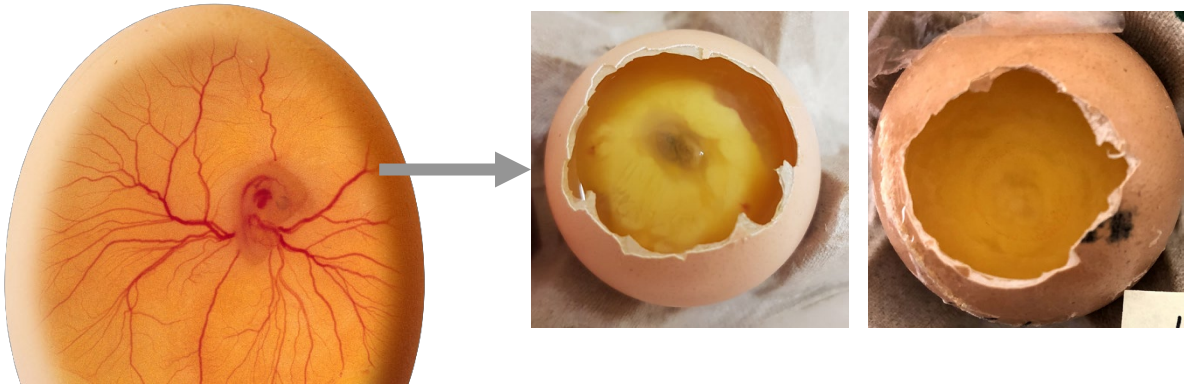
Normal pattern of embryo loss during incubation showing peaks in mortality during early and late incubation



Courtesy of Aviagen

Breakout

- It is not necessarily infertile if you don’t find any signs of blood/bloodring!
- Open at the air cell first
- Hatch residue breakout looks different than shown pictures.



Interpretating breakout results

Recording form

Recording Form 8F: Analysis of clear eggs

Start date of incubation cycle	

Egg ID-code		Breed	
Production date		Maternal age	
Setter number		Storage days	
Hatcher number			

Trolley					
Basket					
Total unhatched eggs					

Category		Number of eggs					Total % of eggs on trays
No.	Description						
1	Gaseous eggs / rots						
2	Cracks before/during setting						
3	Cracks during transfer						
4	Thin/porous egg shell (dehydrated)						
5	Not fertilised (irregular white spot)						

Poll

At which % do you consider to have a problem with early mortality?

> 0.5%

> 3%

> 6%

Breakout comparison

Interpretation by comparing with:

- 'Common sense': it's a problem if > 3 %
- Hatchery specific reference
- Standards of for example breeding company

Flock Age	Stage of Development of Embryo										
	Infertile	24 hours	48 hours	Blood Ring	Black Eye	Feathers	Turned/ Malposi-tioned	Pipped Air Cell	Pipped Shell	Cracked	Contam-inated
Young 25-30 weeks	6	1	2	2.5	1	1	1.5	1	1	0.5	0.5
Peak 31-45 weeks	2.5	0.5	1	2.0	0.5	0.5	1	1	0.5	0.5	0.5
Post Peak 46-50 weeks	5	0.5	1	2.5	1	0.5	1	1	0.5	0.5	0.5
Ageing 51-60 weeks	8	0.5	1	3.0	1	0.5	1.5	1	0.5	1	1

Courtesy of Aviagen

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Summary

Summary

Early embryonic mortality can be related to:

- Breeder flock
- Suboptimal transport conditions
- Suboptimal storage environment
- Improper fumigation
- Improper turning
- Too low or too high incubation temperature

Thanks for watching!

- Webinar-replay + hand-out
- Knowledge section at our website

See you at our next webinar!