

Finish!

~~Start~~ with the end in mind (Part 4): Keeping momentum through the end of the cycle - Persistency

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February 2, 2022

POULTRY INNOVATION PARTNERSHIP

visionary

change

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poultryinnovationpartnership.ca

Layer management – a big topic!

- ▶ **Several stages over the life of a flock**
 - ▶ Each one is dependent on the previous ones
 - ▶ Each one has specific objectives, specific requirements
- ▶ **Series of webinars focusing on each stage**
 - ▶ **Pullets (0 to 13 weeks of age)**
 - ▶ Set-up for a productive life
 - ▶ **Transition to lay (~13 to 20 weeks of age)**
 - ▶ Changes in physiology, nutrient needs, focus on calcium
 - ▶ **Peak production (20 to ?? weeks of age)**
 - ▶ Highest nutrient demand for egg production
 - ▶ **Persistency - finish strong!**
 - ▶ Cumulative effects of long duration of egg production



[https://www.masterfile.com/search/en/photo+finish+track+ace+crossing+the+finish+line](https://www.masterfile.com/search/en/photo+finish+track+race+crossing+the+finish+line)

Pullet rearing – Key Points

▶ **Body weight and composition**

- ▶ **On target or slightly above**
 - ▶ **Frequent weighing, fleshing**
 - ▶ **Make small, subtle changes more frequently**
 - ▶ **Encourage feed (nutrient) intake**
 - ▶ **Fibre source to increase gut capacity**
 - ▶ **“Stack” feeding – train to eat more frequent meals**
- ▶ **If underweight**
 - ▶ **Delay feed phase changes**
 - ▶ **Manage stress – return to an earlier phase if needed**
 - ▶ **Delay photostimulation**

▶ **Uniformity**

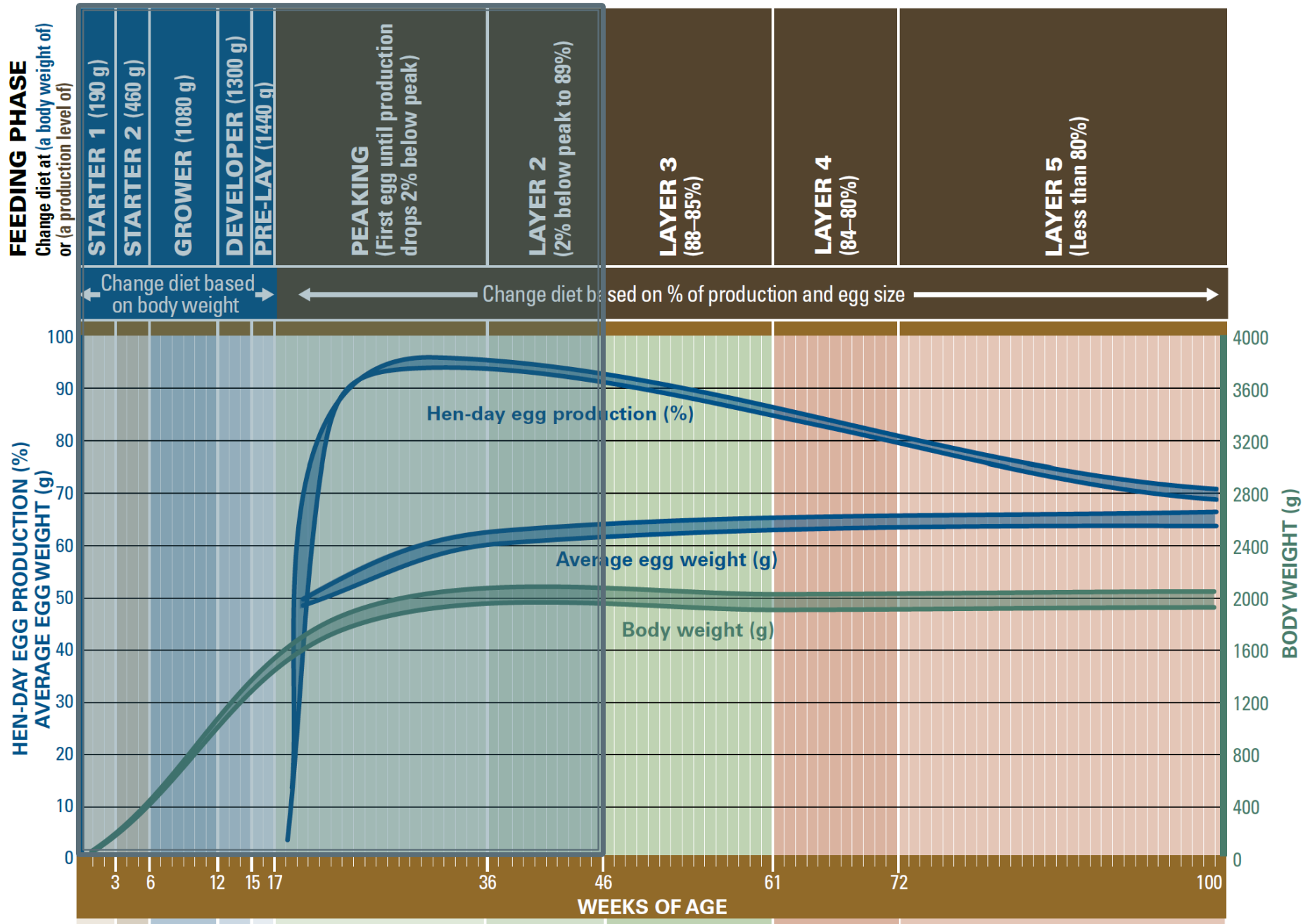
- ▶ **Ideal: Every bird has the same nutrient requirements, will respond to photostimulation at the same time**

Pullet transition – key points

- ▶ **Pullet nutrition – continue with the end in mind**
 - ▶ Make decisions that will lead to success in the long run, not just minimize short-term cost
 - ▶ Remember: the pullet is an investment in future egg production (and profit)
- ▶ **Frequent weighing and fleshing**
 - ▶ Delay photostimulation if target weight and composition not achieved
 - ▶ Estrogen surge depends on body composition and age
- ▶ **Allow sufficient time to deposit medullary bone before first egg**
 - ▶ Optimum structural bone reserves

Feeding to peak and beyond – key points

- ▶ **Start with a uniform flock**
 - ▶ Pullet management and nutrition
- ▶ **Egg size can be managed somewhat**
 - ▶ Small hens will lay smaller eggs
 - ▶ Risk of inadequate nutrient reserves, nutrient intake
- ▶ **Average daily egg mass (% production X average egg weight)/100 is the main driver of nutrient requirements**
 - ▶ Feed accordingly





WHERE
ARE WE?

Longer laying cycles, greater persistency...

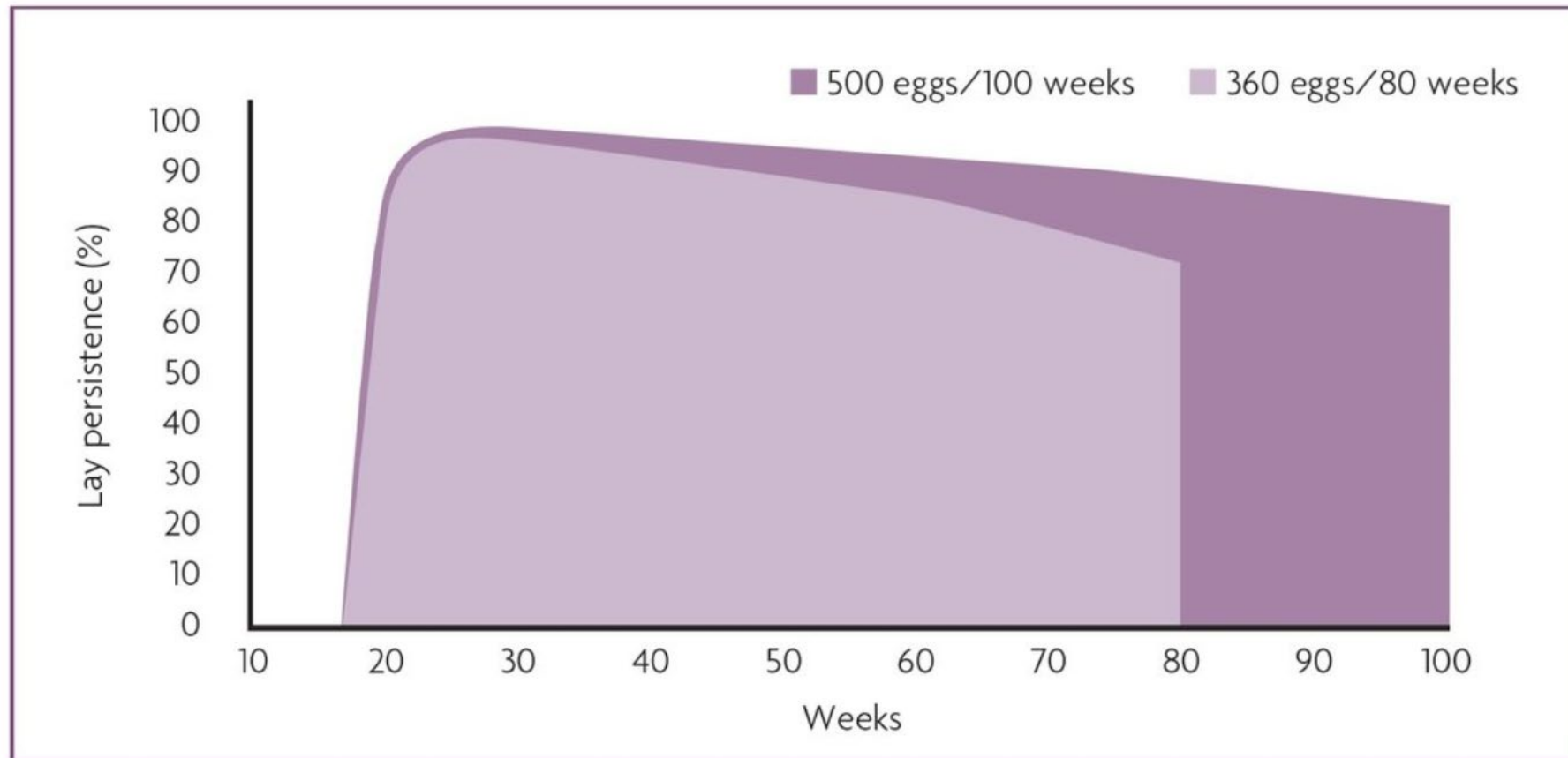
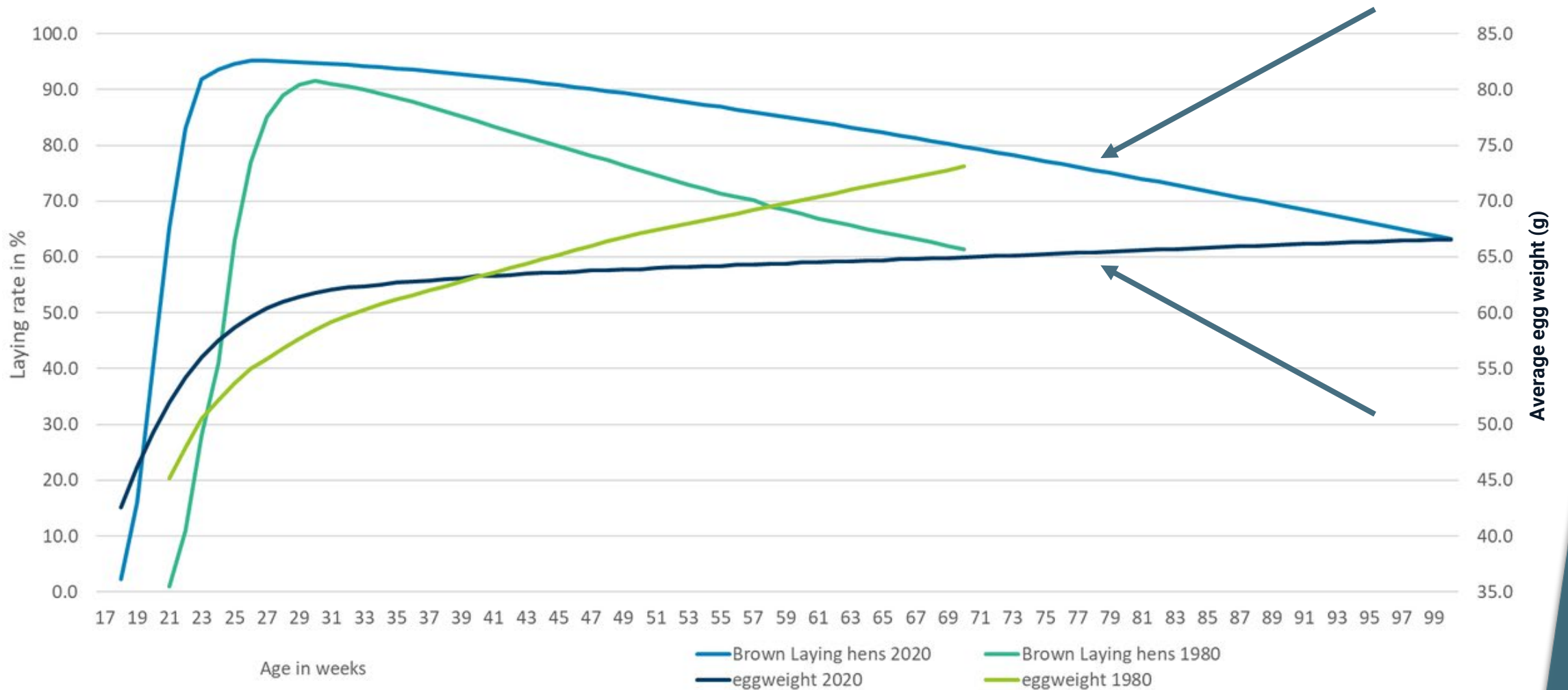


Fig. 1. Improvement in egg production and production period length (ISA white birds).

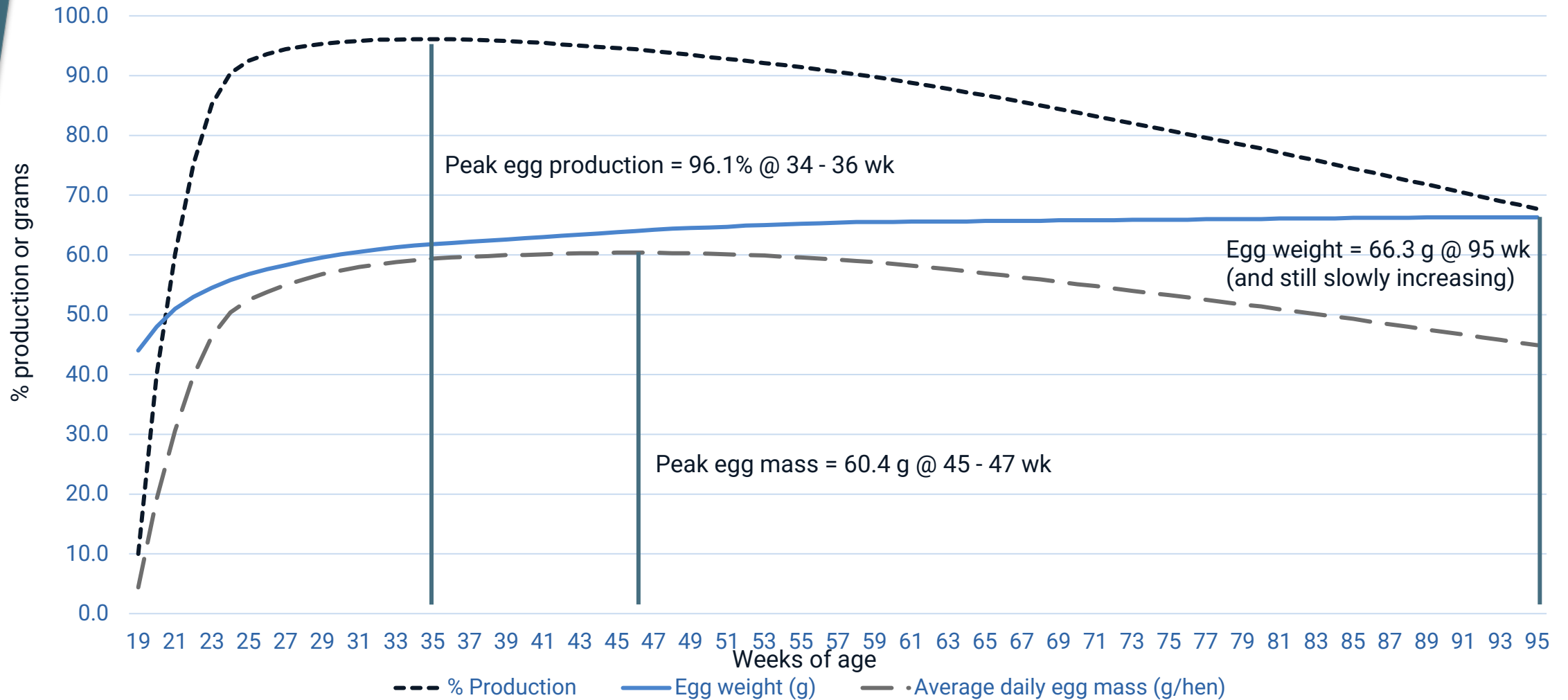
P. Rutten

www.dekalb-poultry.com/en/news/how-feed-layers-longer-production-cycle-and-high-performance/ ⁸

Selection for persistency – 1980 vs 2020



Egg production and nutrient requirements

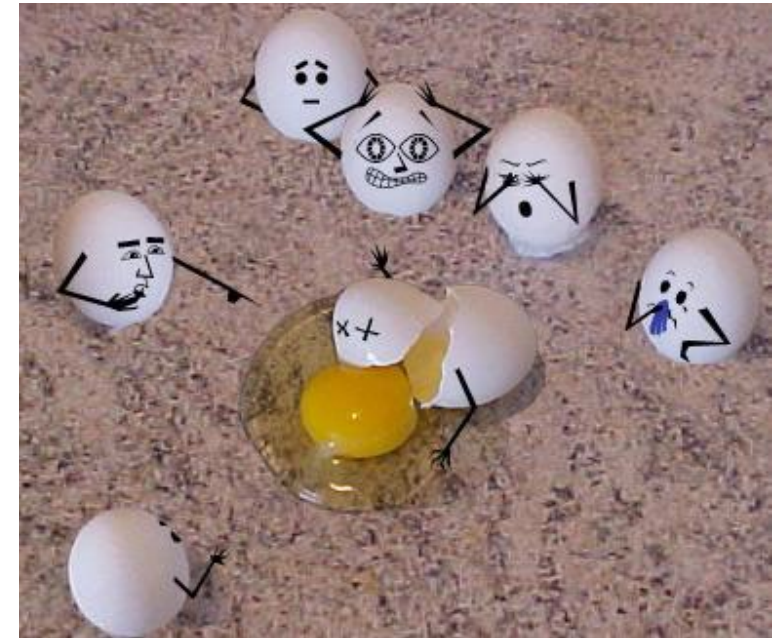
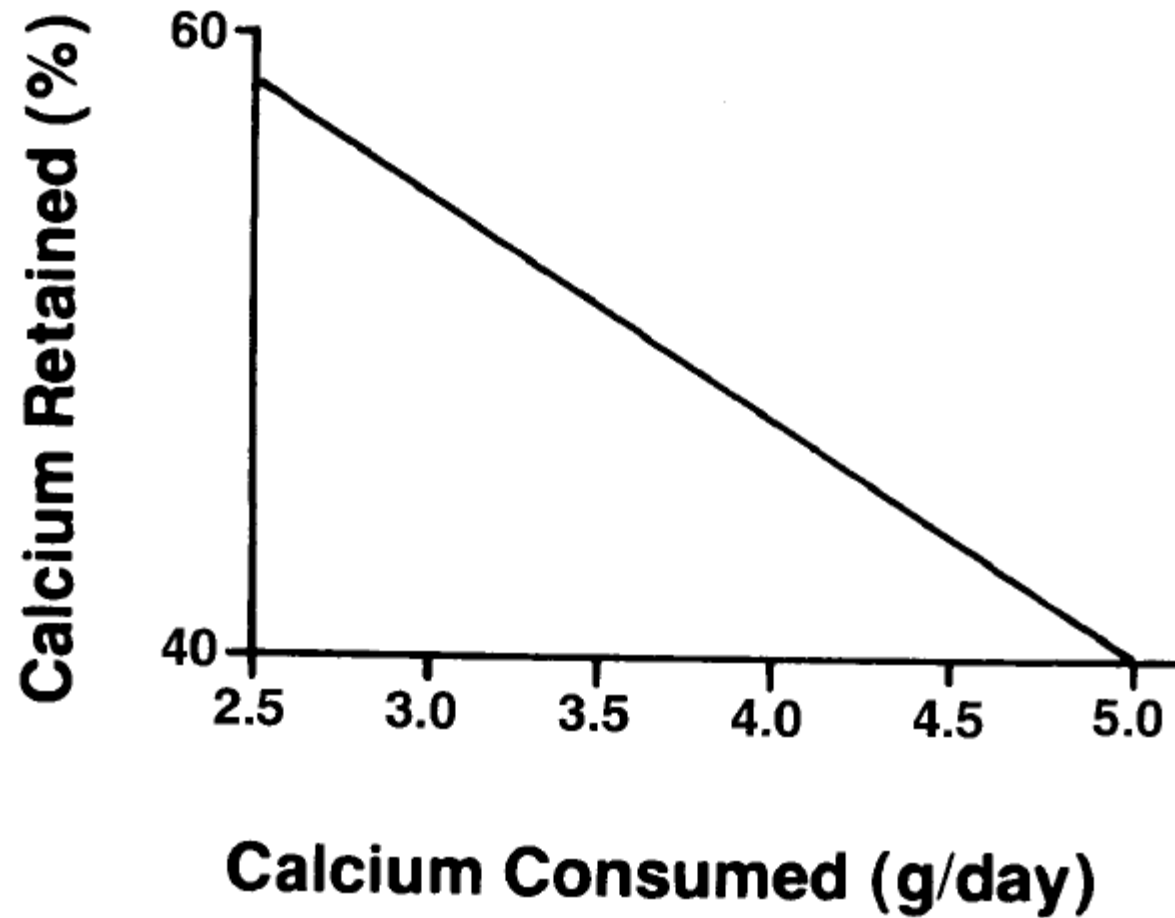


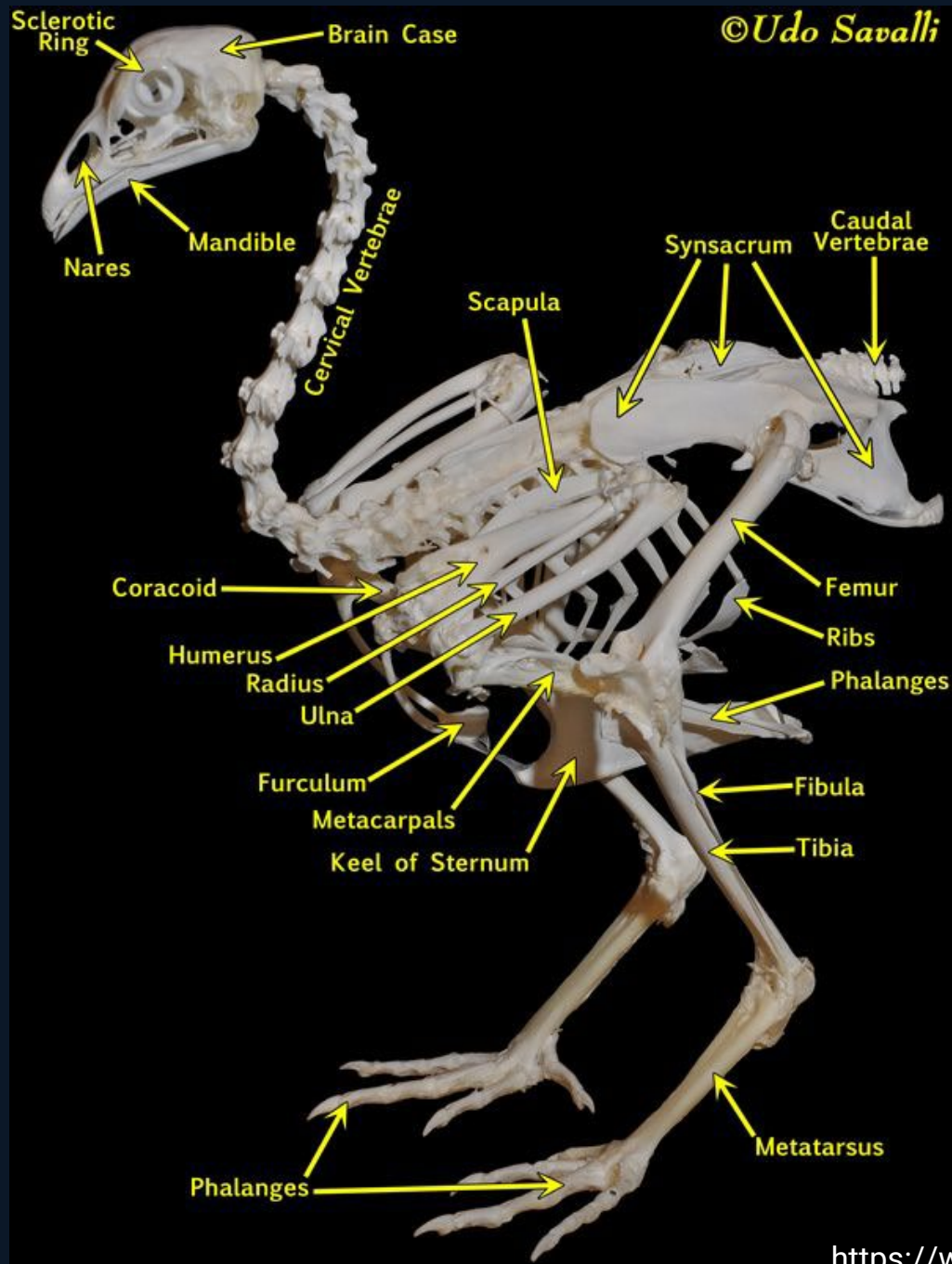
Feeding the hen to peak and beyond

- ▶ **What drives nutrient requirements?**
 - ▶ **Body mass – maintenance**
 - ▶ Slow increase in body weight, slow increase in maintenance requirements
 - ▶ Increased in extensive housing – more activity
 - ▶ **Average daily egg mass**
 - ▶ $(\text{Average egg weight} * \% \text{ production})/100$
 - ▶ **Slightly reduced feed intake from post-peak to end of cycle**
 - ▶ Decrease energy intake
 - ▶ Decrease amino acid, available P density
 - ▶ Increase Ca

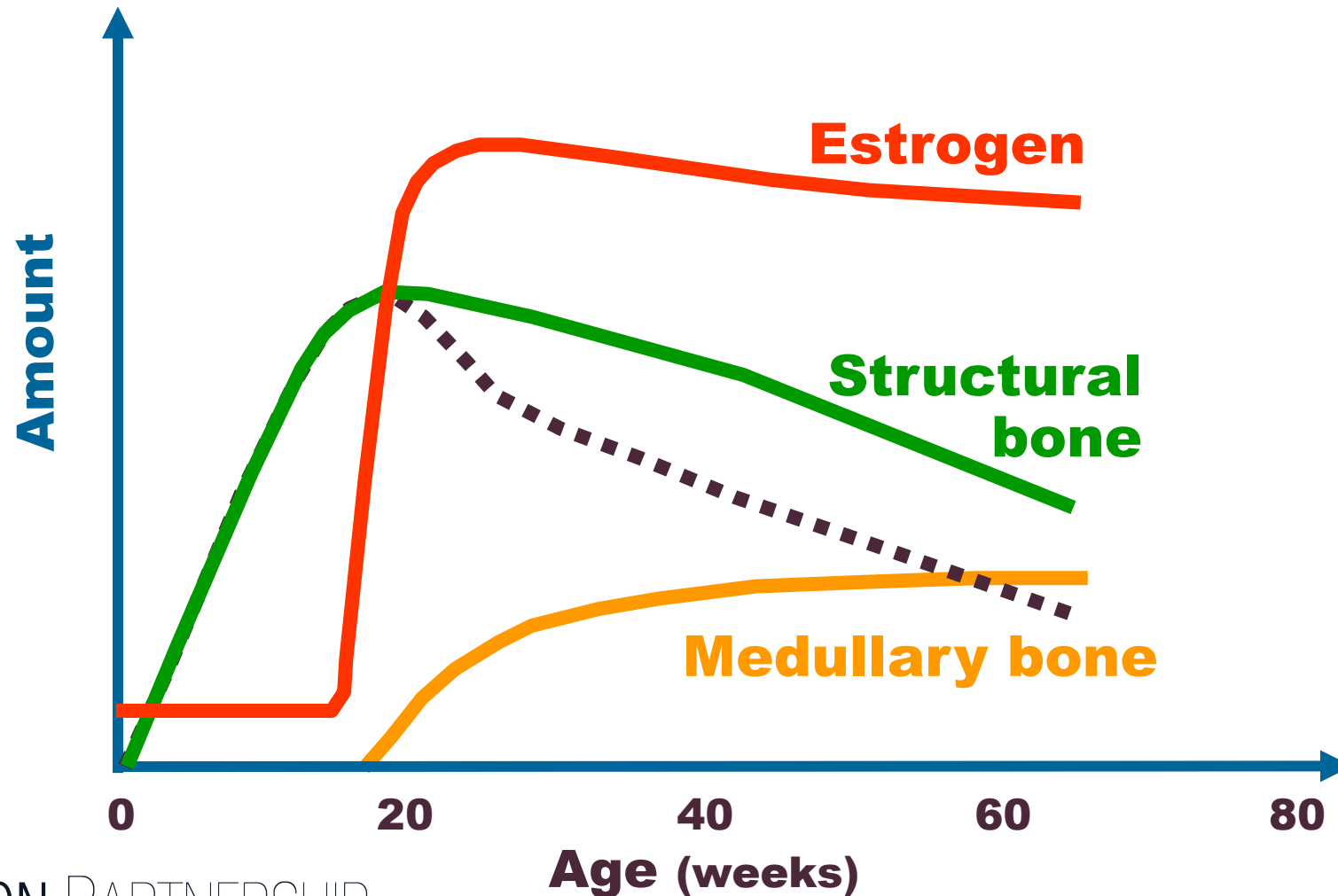


Maintain Shell Quality





Estrogen-driven changes in medullary and structural bone



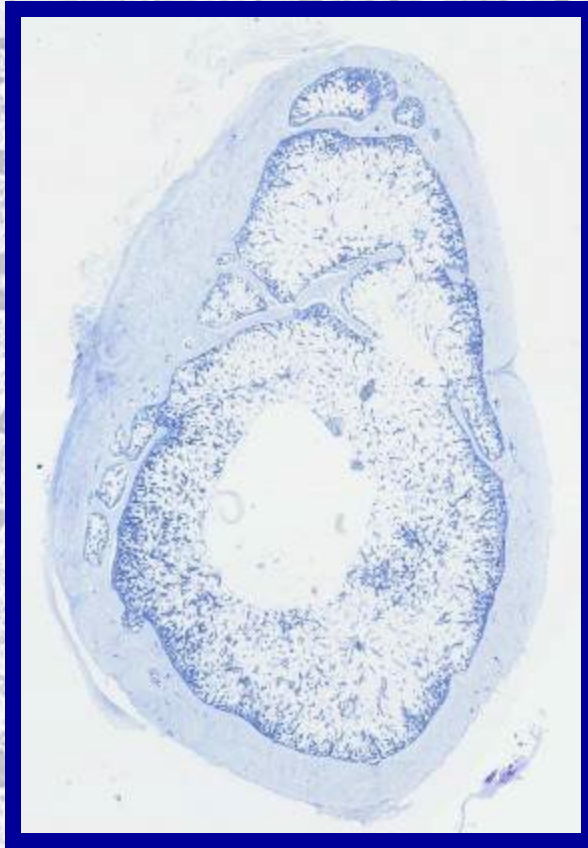
Slide courtesy
of Bob Fleming

Medullary bone and cortical thinning in the proximal femur

16 weeks

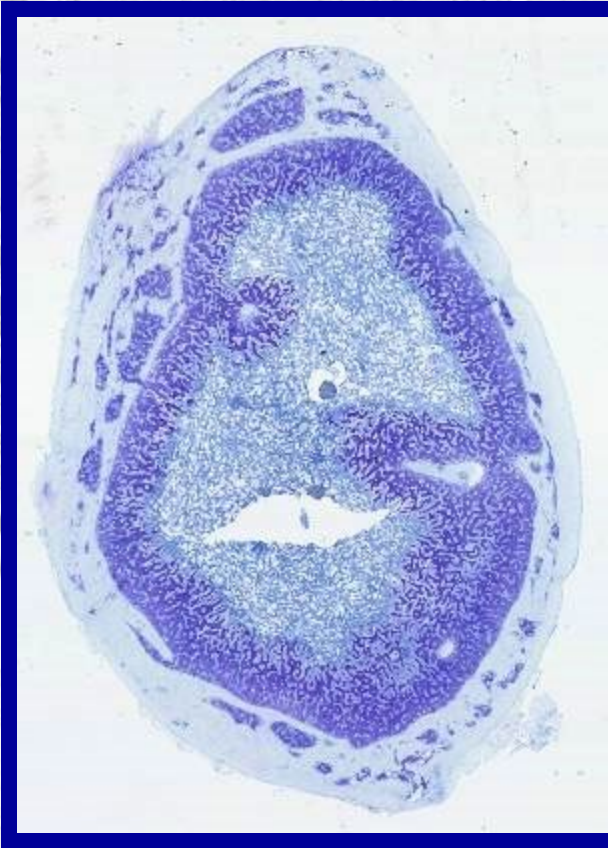
1st egg (~20 wks)

67 weeks



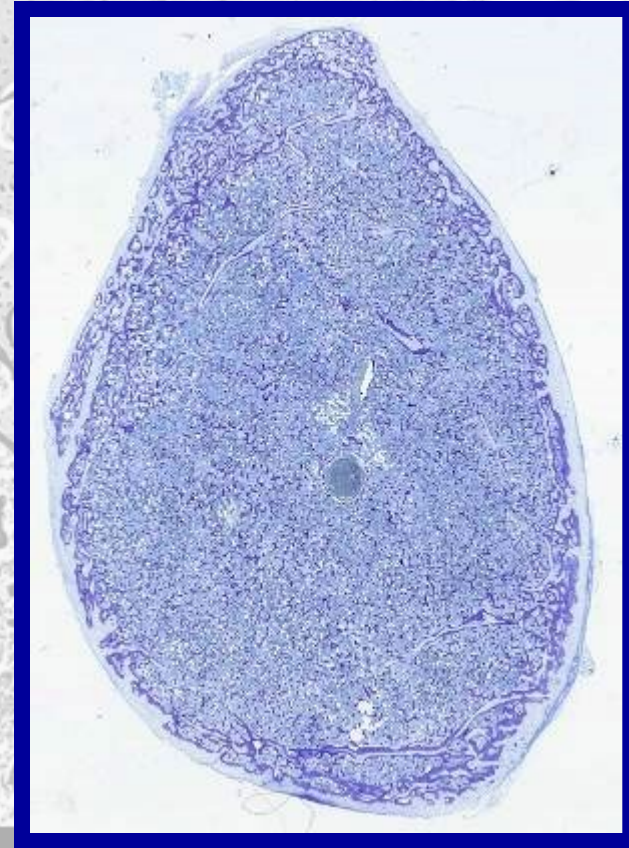
No MB

Thick cortex



Dense lining MB

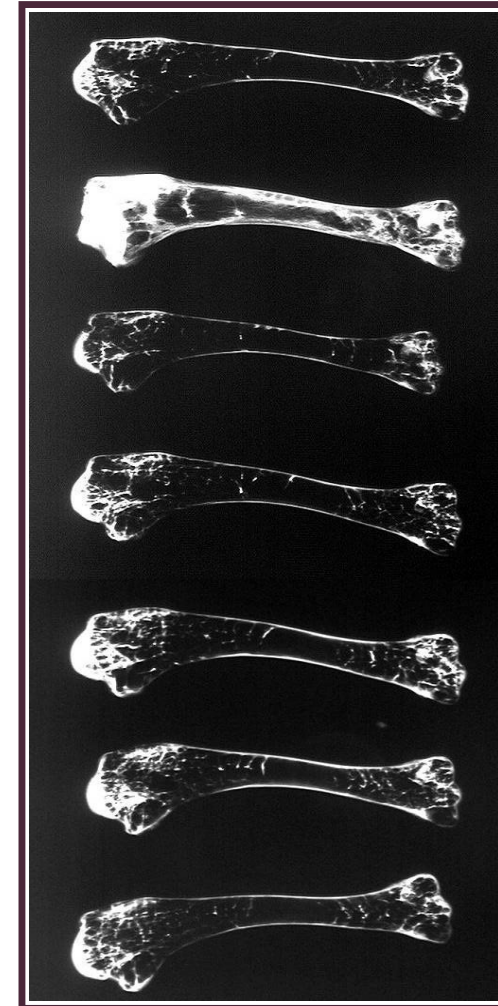
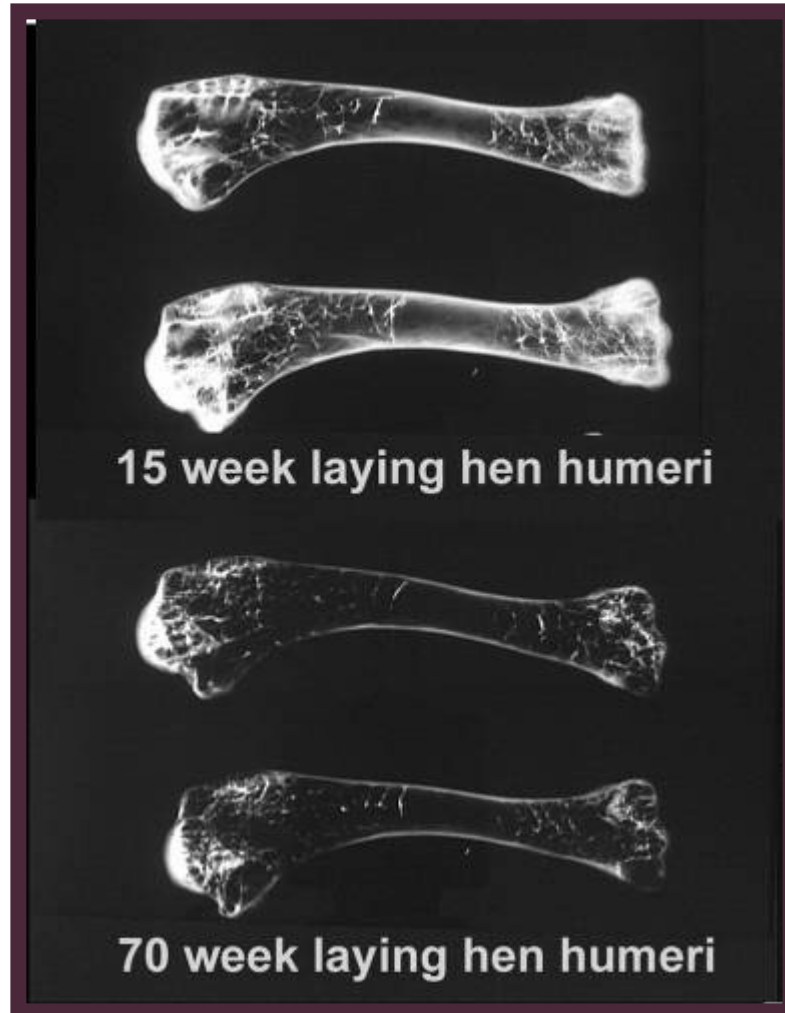
Thick cortex



Diffuse MB

Thin cortex

Structural bone depletion



Images courtesy of Bob Fleming

Severe bone fractures

- ▶ **Osteoporosis**
 - ▶ Loss of structural bone mass
- ▶ **Bone Breaks**
 - ▶ During production phase
 - ▶ Healing can occur
 - ▶ Breaks during depopulation
- ▶ **Production losses**



Severe bone fractures

- ▶ Osteoporosis
- ▶ Cage-free systems
 - ▶ Keel breaks



Tarlton et al., 2012



Normal Fracture Damage



<http://animalbiosciences.uoguelph.ca/content/new-aviary-systems-and-laying-hen-welfare>

Bone Ca mobilization

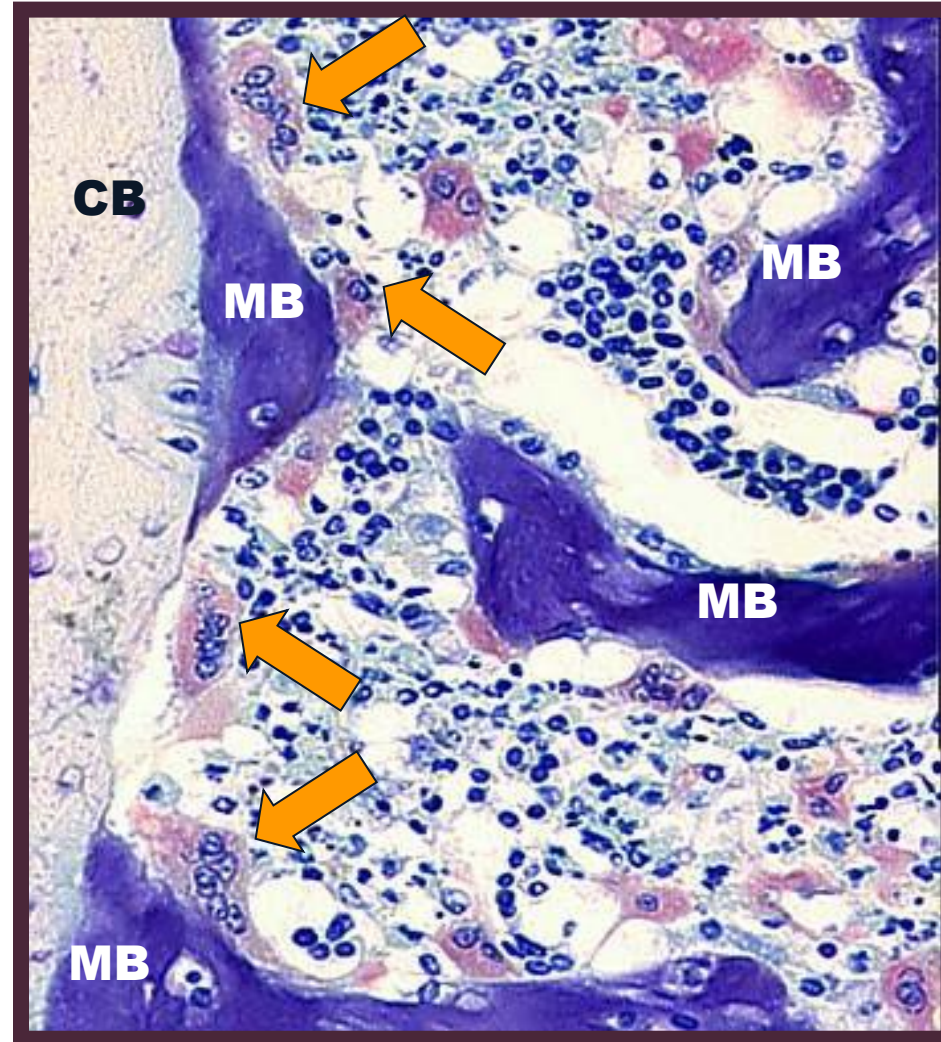
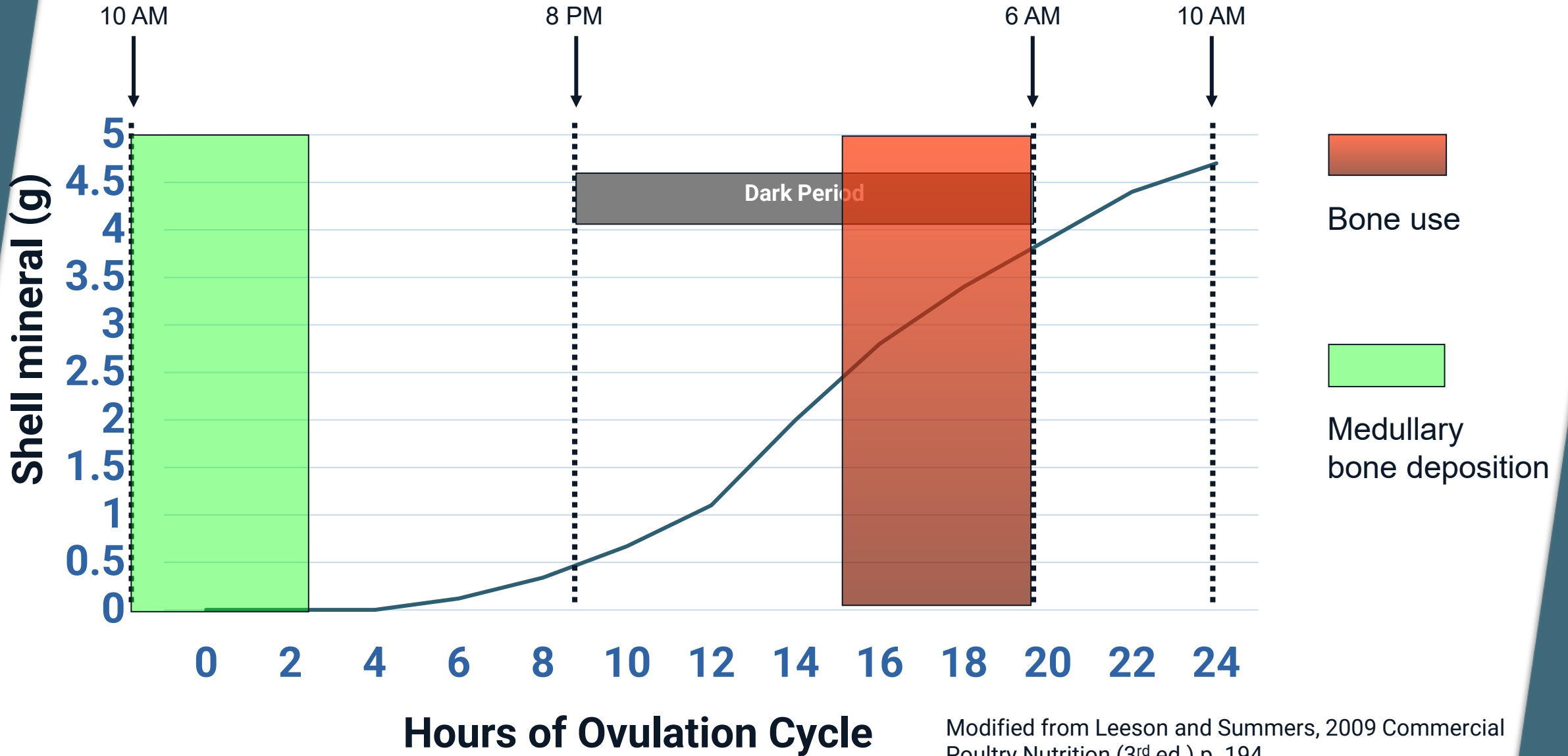


Photo courtesy of
Bob Fleming



Modified from Leeson and Summers, 2009 Commercial Poultry Nutrition (3rd ed.) p. 194

Eggshell formation

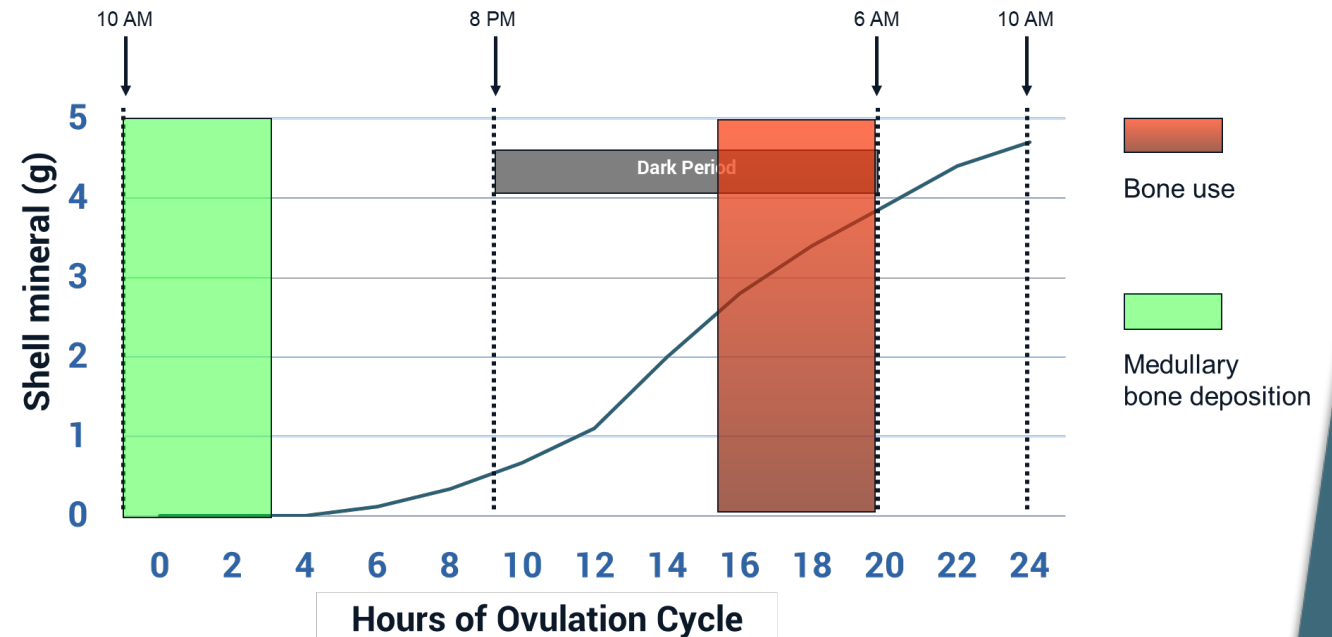
- ▶ **60-80% of calcium required for eggshell formation derived directly from the diet on shell-forming days**
- ▶ **The greater the proportion of eggshell calcium derived directly from the diet, the better the shell quality**



Ca particle size

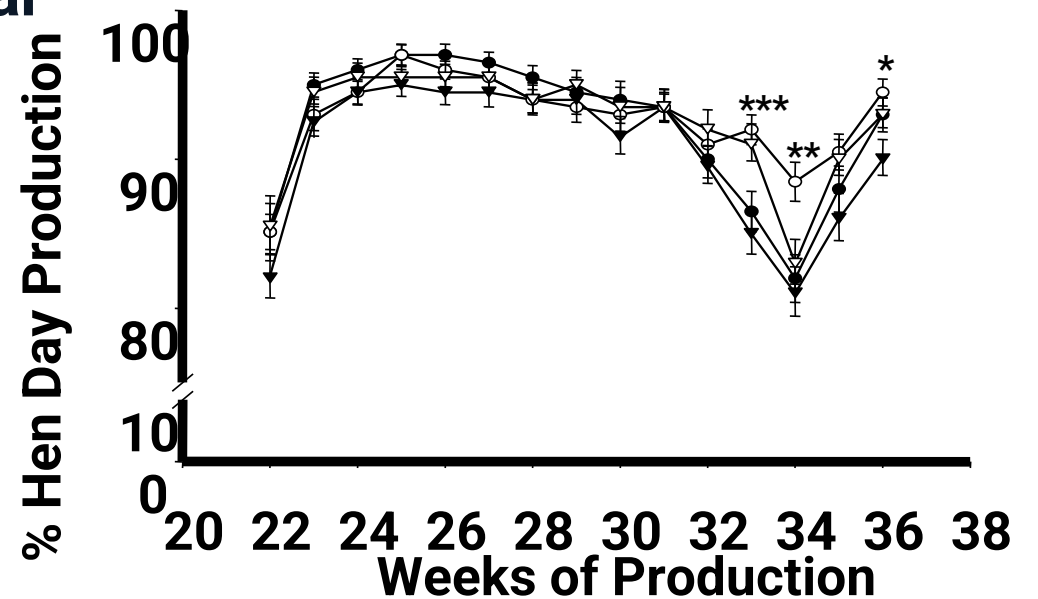
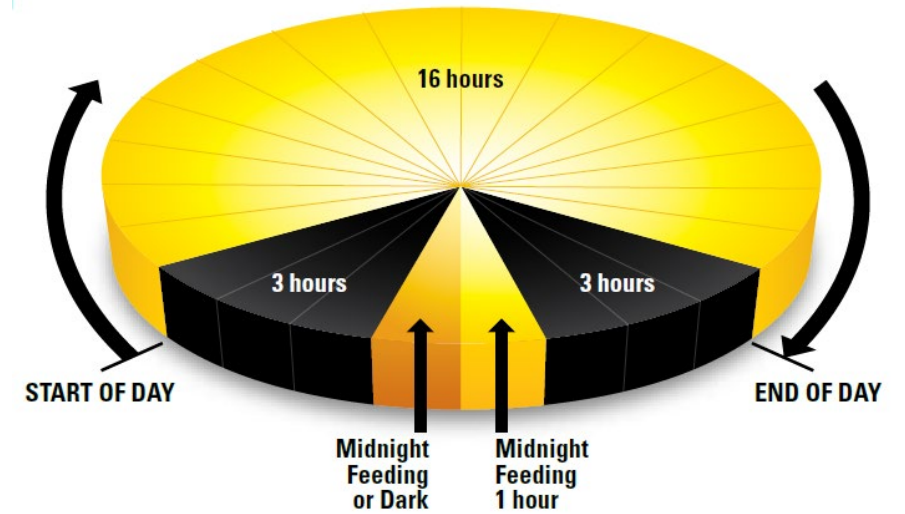
▶ Large particle calcium sources

- ▶ 2/3 large particle (> 1mm; larger is better)
 - ▶ Retained in gizzard
- ▶ 1/3 small particle (<1 mm)
 - ▶ Quickly available
- ▶ Top-dress feed – oystershell (emergency)
- ▶ Free choice Ca (floor-housed birds)



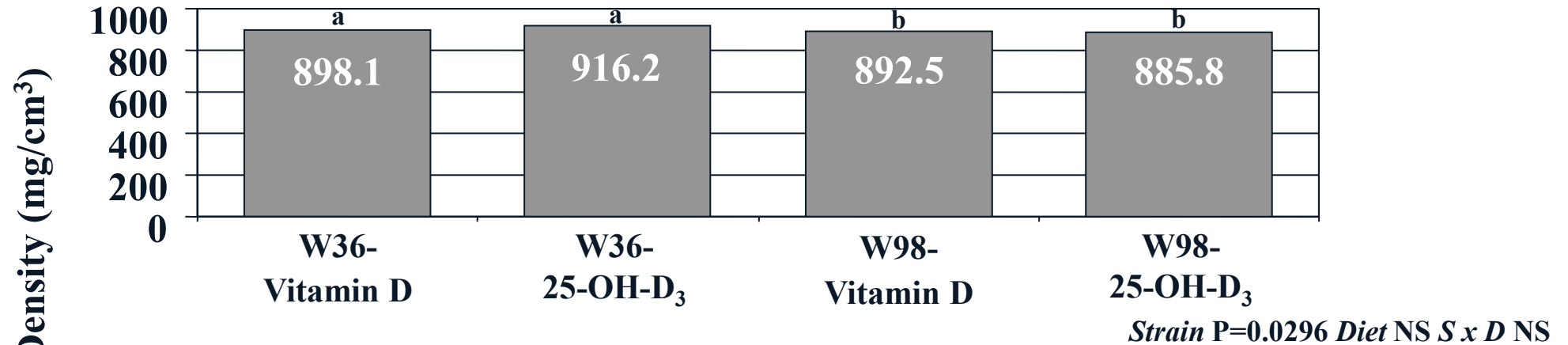
Midnight feeding

- ▶ Allow access to feed for 1 hour in the middle of the night
- ▶ Dietary calcium available during peak eggshell formation
- ▶ Short duration of lighting does not appear to affect photoresponsiveness
 - Also has benefits in hot environments
 - Some of the heat increment shifted to cooler time of the day

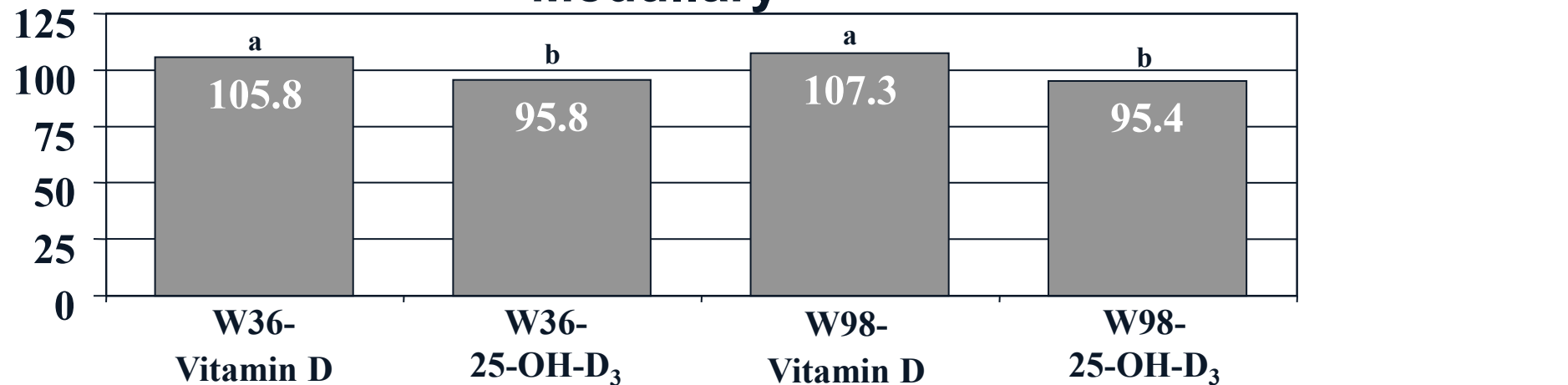


25-OH-D₃ & laying hen bone density

Cortical

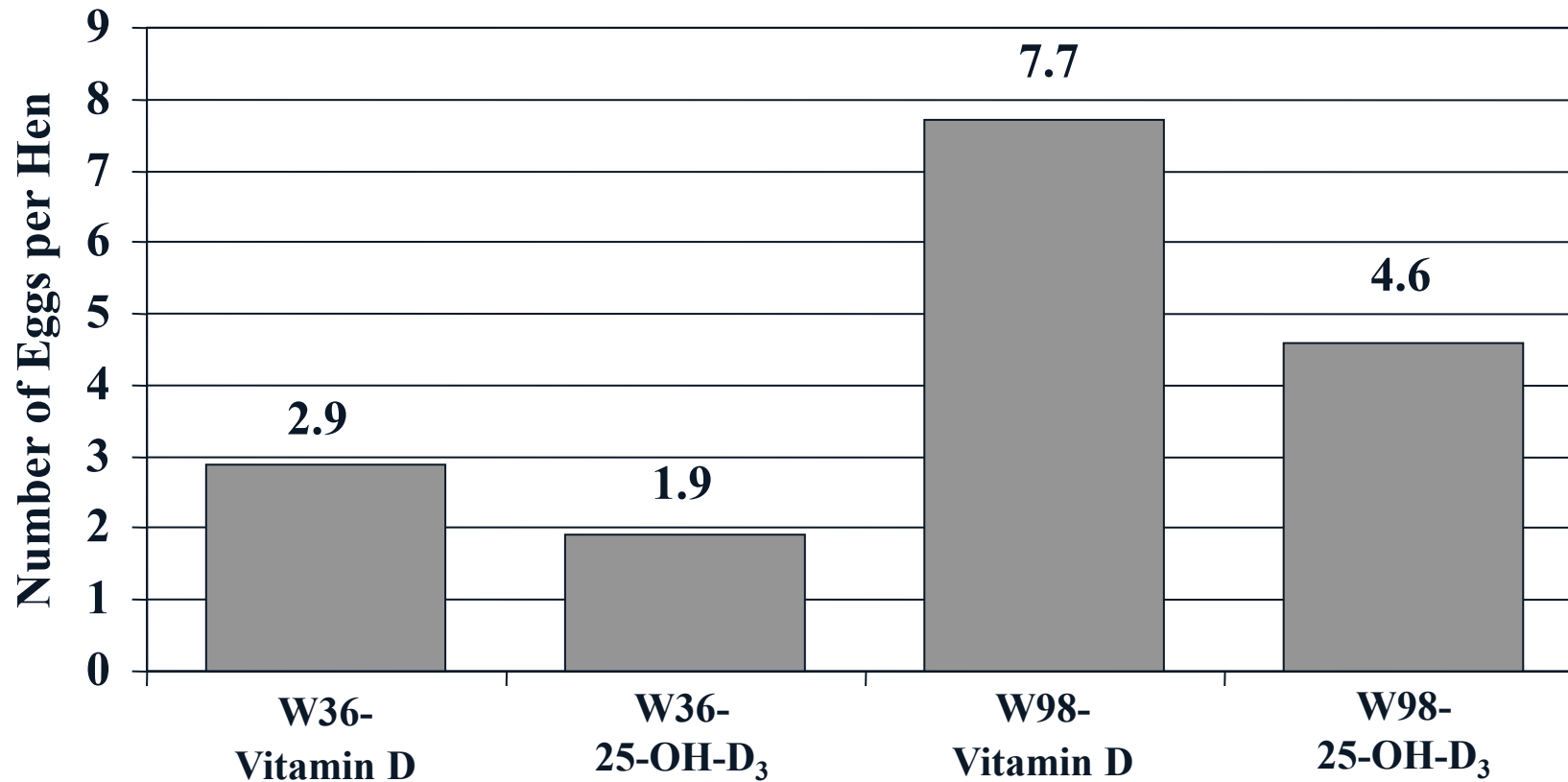


Medullary



25-OH-D₃ & shell quality

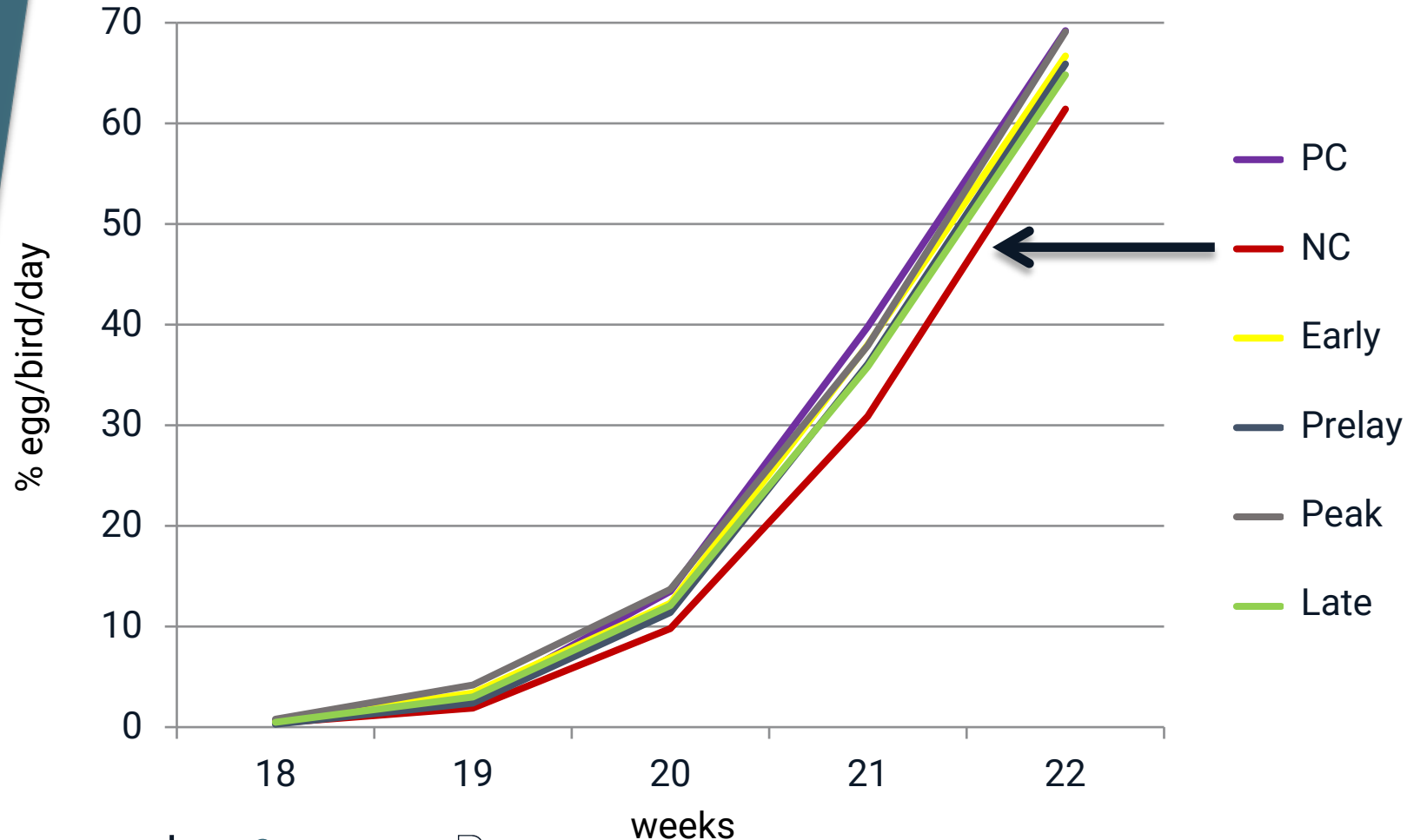
Defective Shells



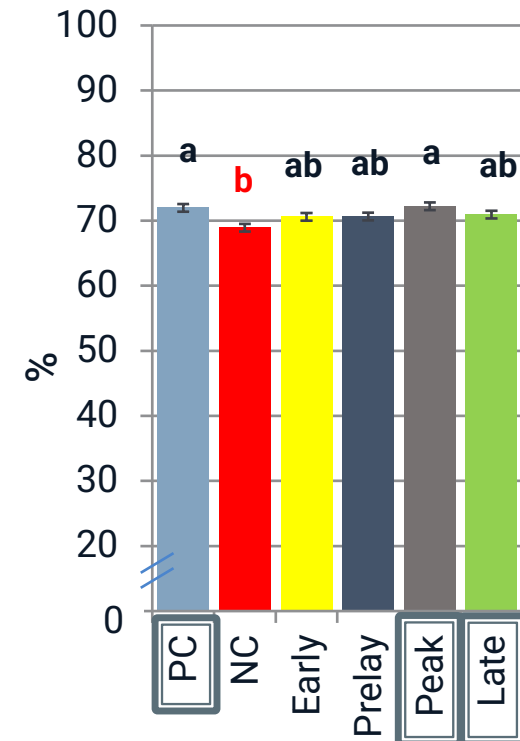
Strain	0.0005
Diet	0.0449
S x D	NS

25-OH-D₃ Field Trial - Colombia

Onset of lay (18-22 wk of age)



Early lay
17 to 34 wk



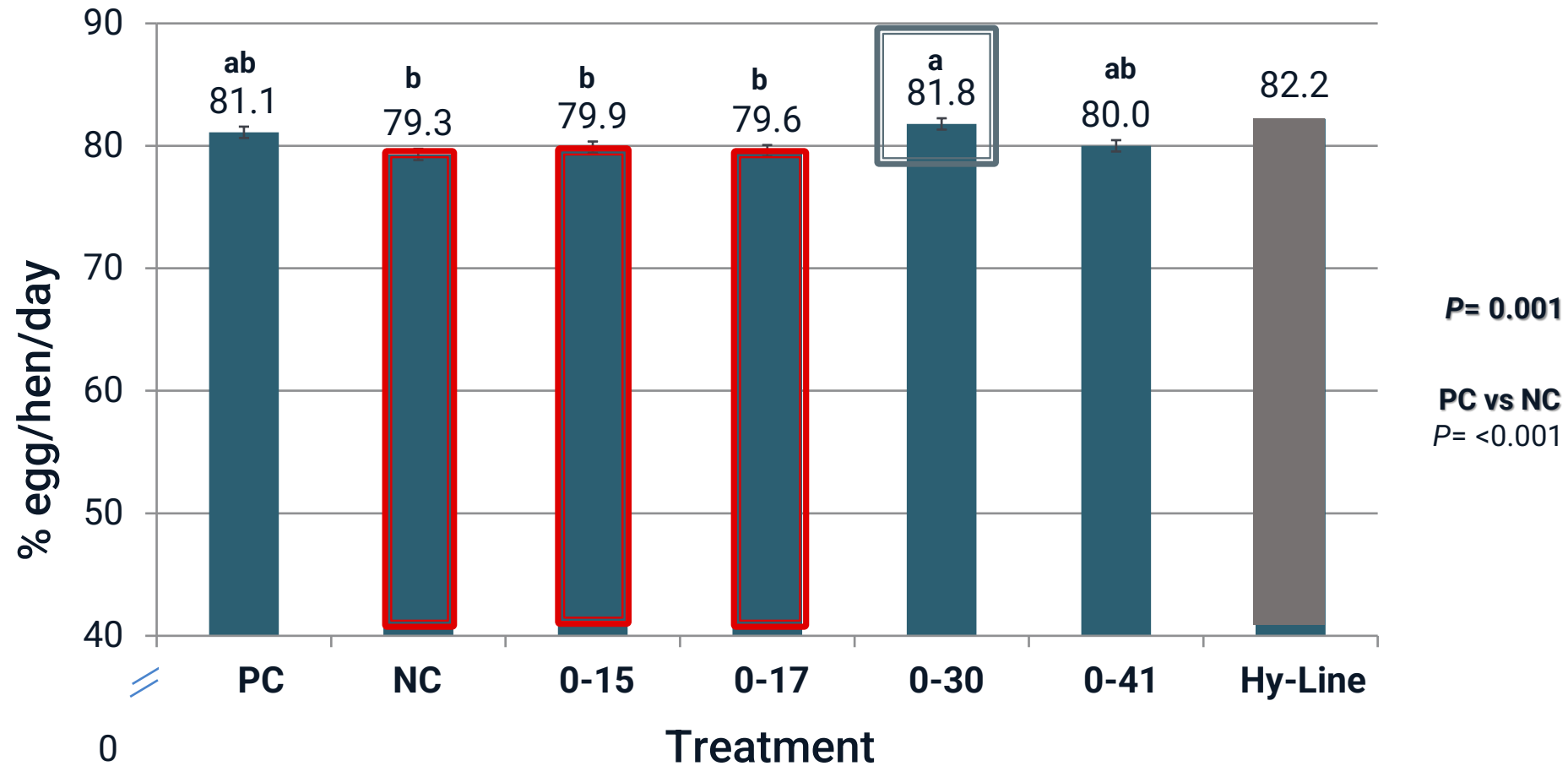
P= 0.004

25-OH-D₃ vs NC

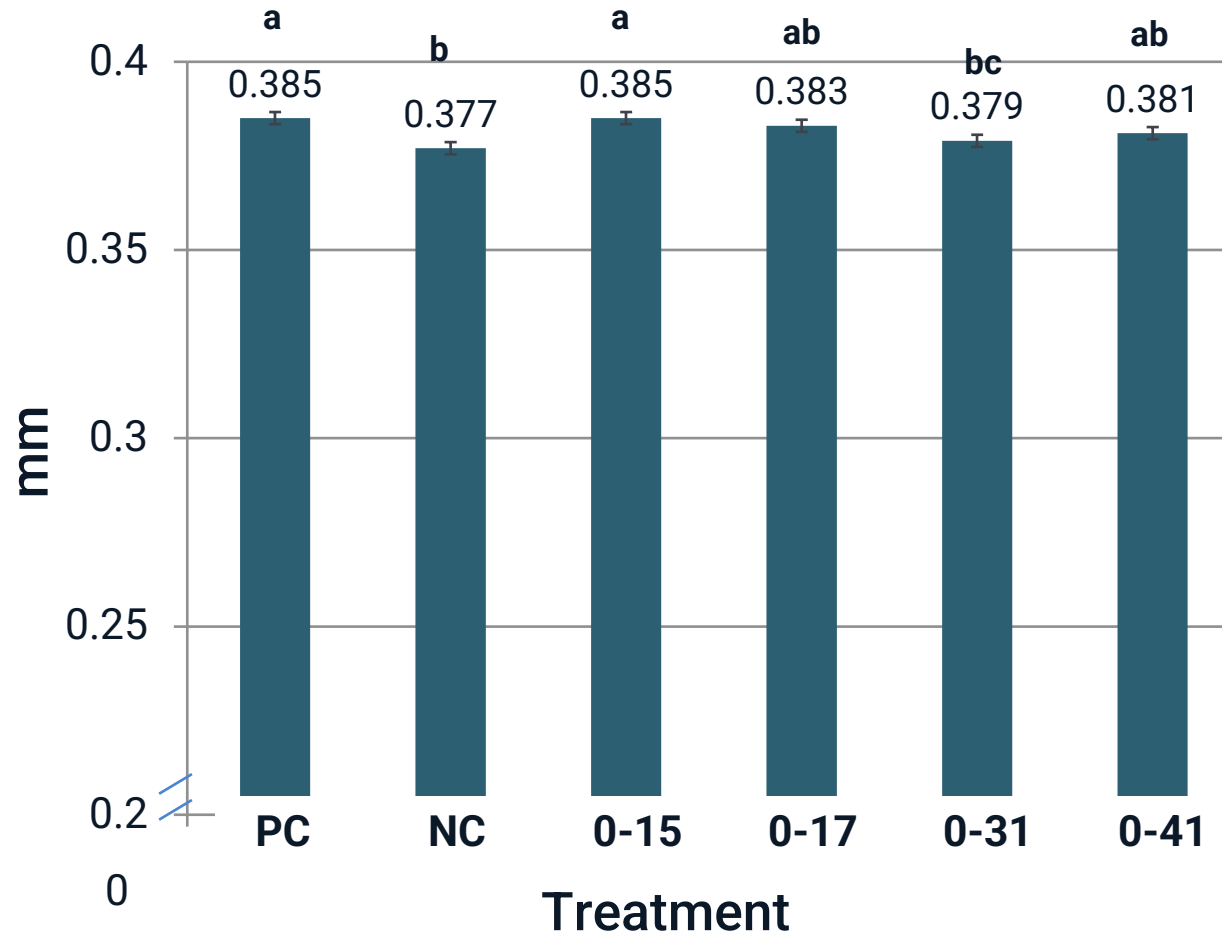
P= <0.001

Egg per hen housed – 18 to 87 wk

Egg production (18 to 87 wk of age)



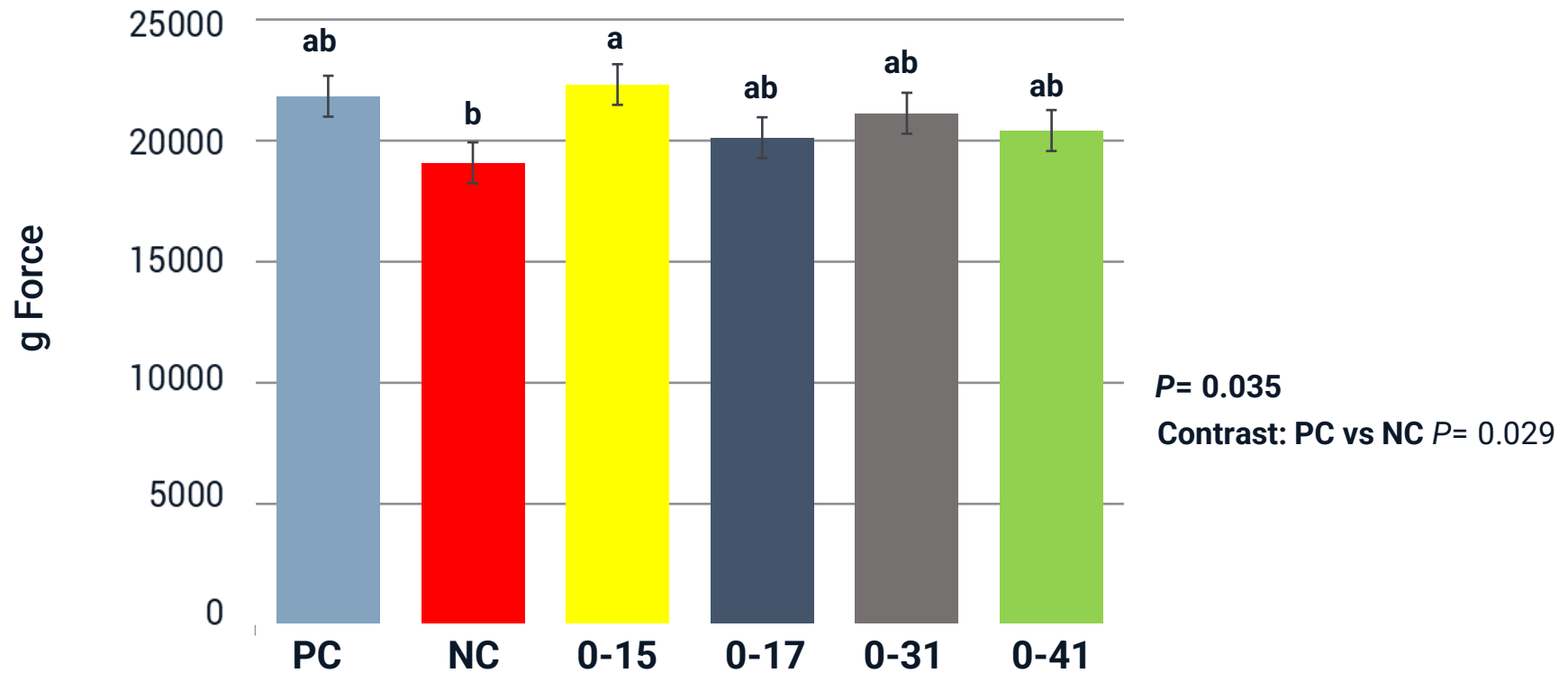
Shell thickness – overall



Contrast		
40-48 wk	PC and Late vs. NC	0.719
53-75 wk	PC vs. NC	0.033
77-87 wk	PC vs. NC	<0.001
Overall	PC vs. NC	<0.001

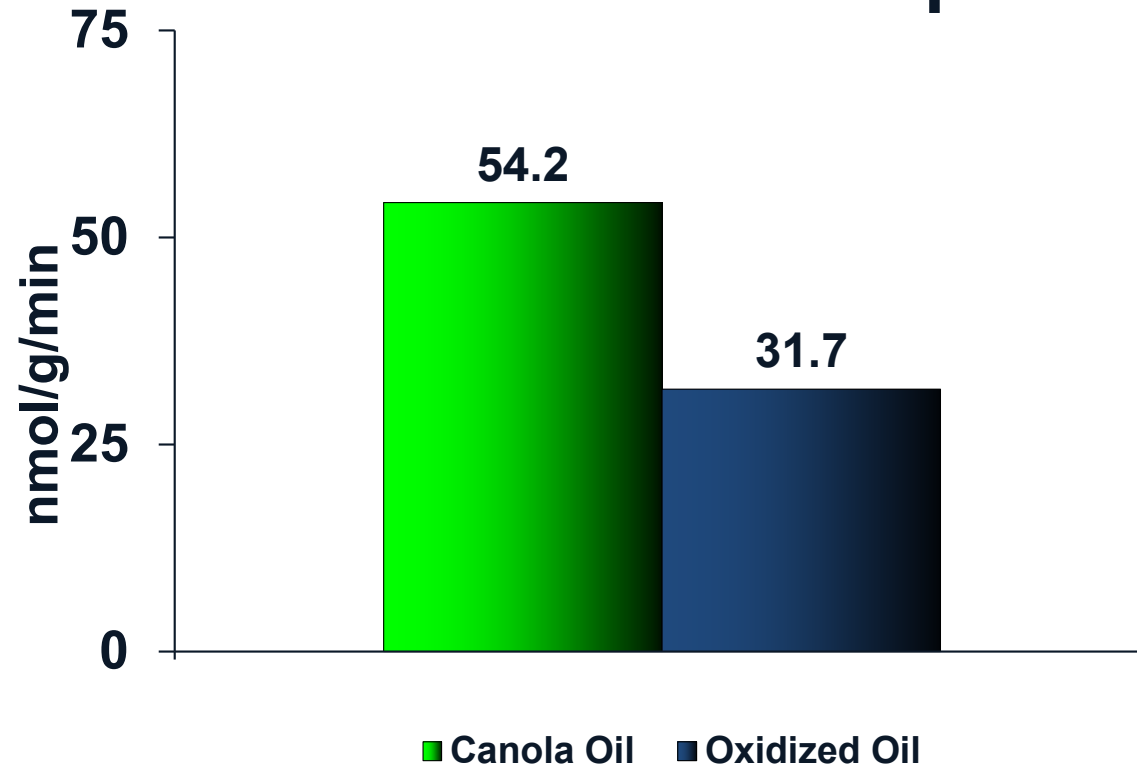
P= <0.001

Bone breaking strength – 90 wk of age

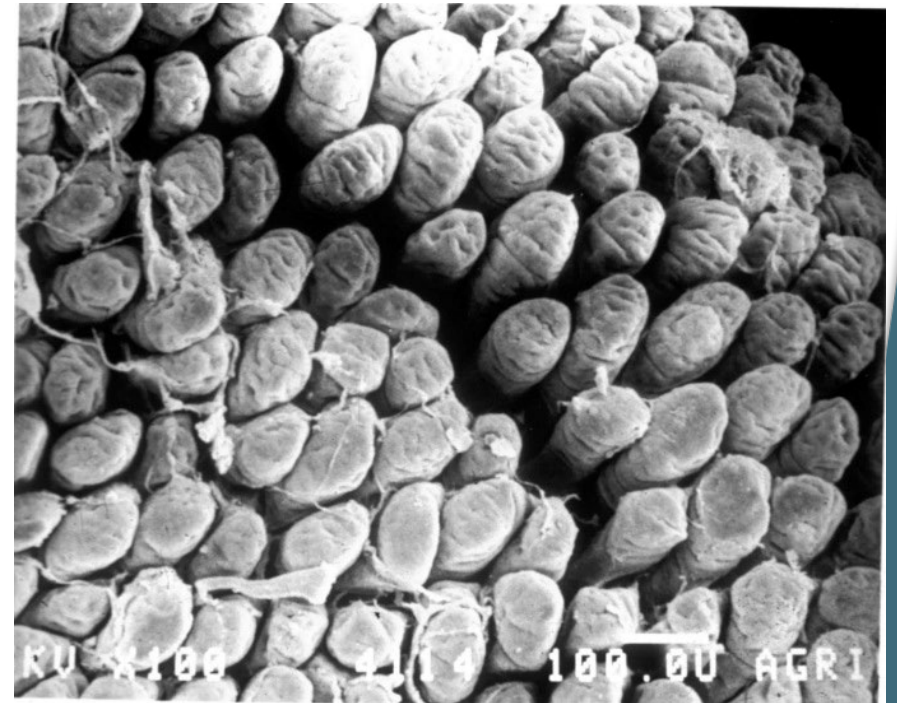


Feed oil quality

Duodenal calcium uptake



R. Renema



- Feed/fat quality can affect the condition of the surface of the gut and the ability to absorb nutrients

Heat stress

- ▶ **Environmental temperature**
 - ▶ Minimize heat stress
- ▶ **Electrolyte balance**
 - ▶ Panting causes a loss of CO_2
 - ▶ Blood pH increases from 7.2 to 7.5-7.7
 - ▶ Loss of bicarbonate ions limits CaCO_3
 - ▶ Limits shell formation
 - ▶ Replace 30-35% of NaCl with NaHCO_3



Water Ca supplementation

- ▶ **Water supplementation of calcium**
 - ▶ **Effective, but use with caution**



Prevention or cure?

- ▶ **Prevention – maintain high productivity, bird health, shell quality**
- ▶ **“Cure” – make things less bad**
- ▶ **Manage your birds to avoid problems in the first place**
 - ▶ **“Saving” money can be more expensive over the life of the flock**



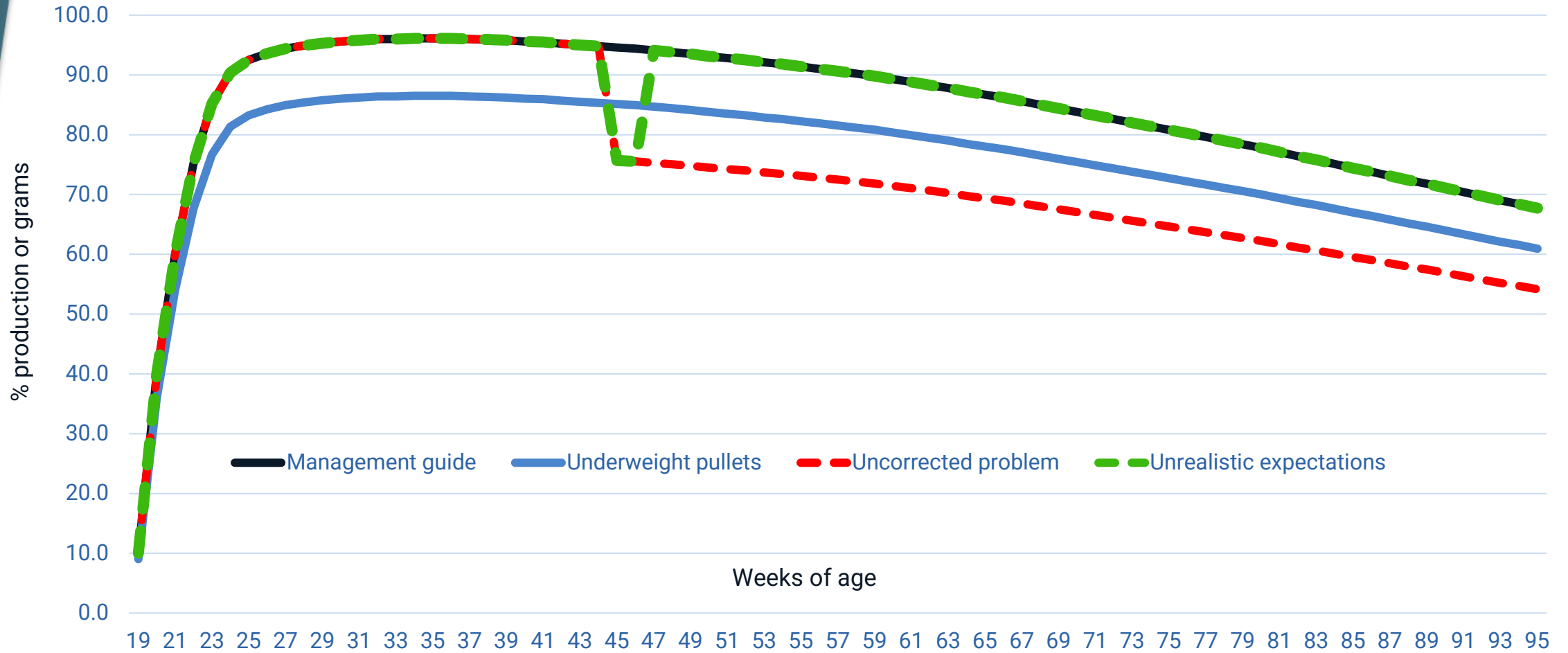
Identifying and fixing (?) problems – realistic expectations

- ▶ **Can the damage be overcome?**
 - ▶ Small problems are usually easier to fix than big problems
 - ▶ Discovering problems sooner is more likely to lead to correction than discovering them later
 - ▶ Small problems can accrue over time
 - ▶ Become major problems
 - ▶ Multiple small problems can lead to poor outcomes



<https://www.skipprichard.com/7-steps-to-problem-solving/>

Identifying and fixing (?) problems – realistic expectations



Summary and conclusions

- ▶ **Success with long production cycles starts with the pullet**
- ▶ **Shell quality is often the limiting factor for extended laying cycles**
- ▶ **Reduce reliance on bone calcium → increase shell quality**
- ▶ **Prevention is far more effective than reaction**

Thank you!

Questions?

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