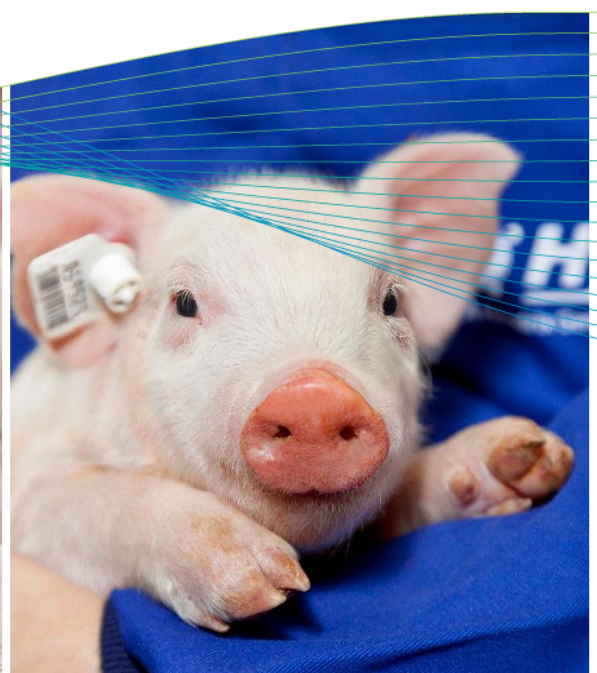
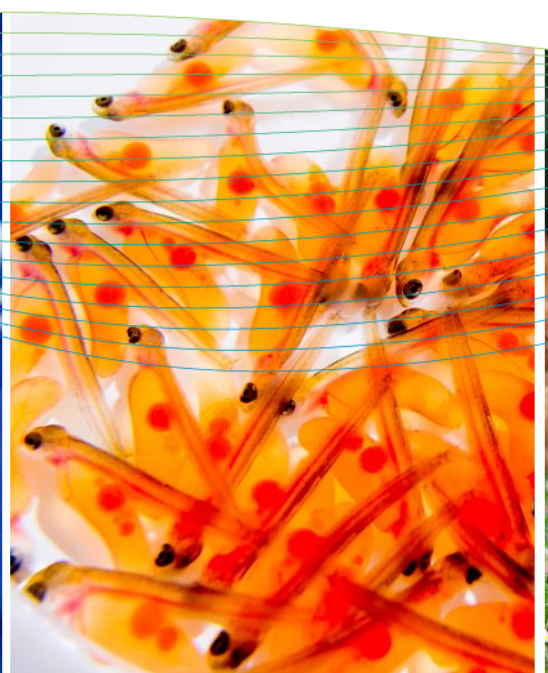
Poultry and Swine breeding in the 21st century

'26-04-16 Teun van de Braak

HENDRIX GENETICS

Hendrix Genetics is a global multi-species animal breeding company, active in layers, turkeys, swine, aquaculture, and traditional poultry.

With operations in 22 countries and over 3,000 employees, we deliver high-quality genetics and long-term support to animal protein producers worldwide.

Global operations in 22 countries

Layers Turkeys Swine Salmonids Shrimp Traditional Poultry

Continuous Investment in R&D

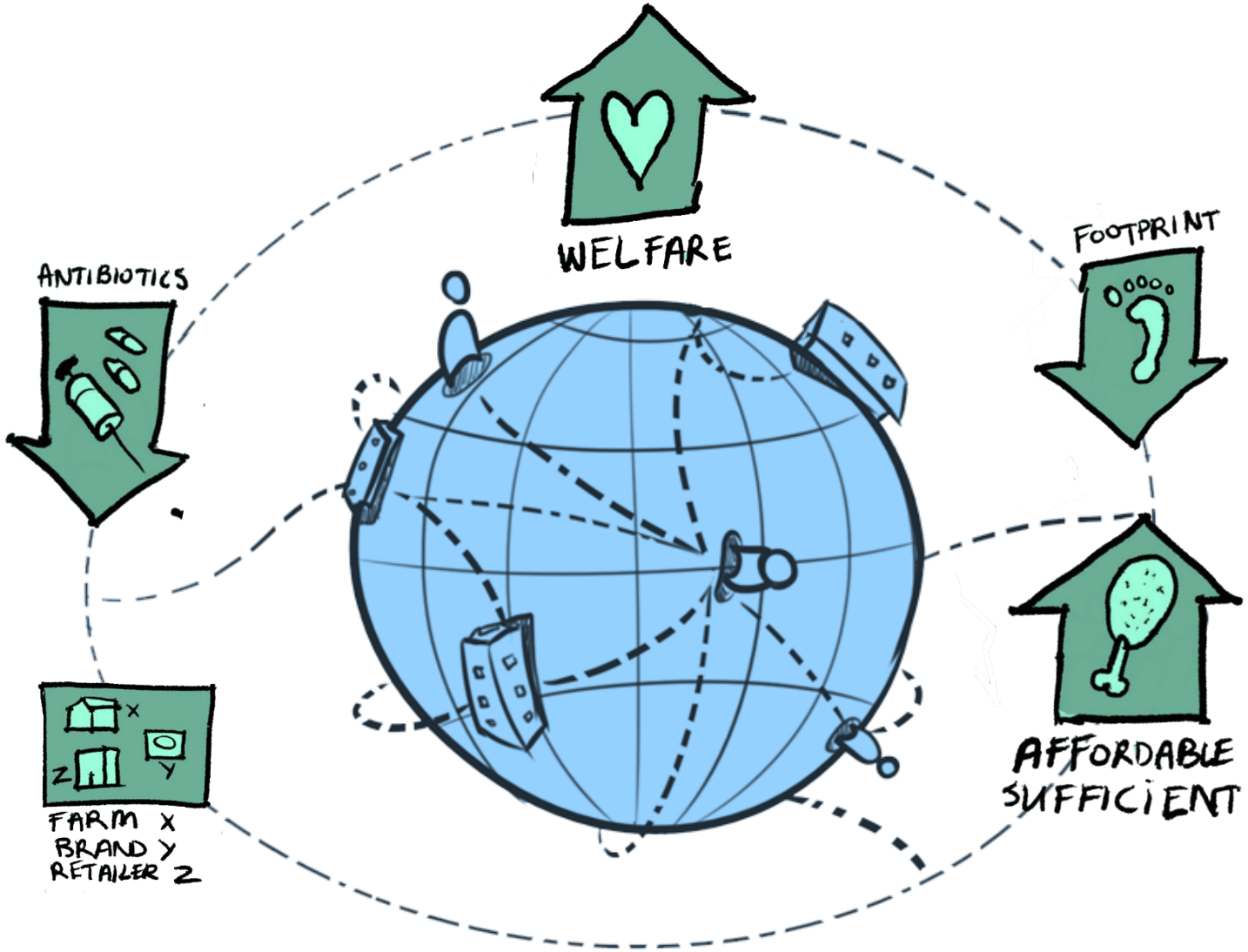
Our vision

“setting the standard for sustainable animal breeding”

But What is Sustainability?

"meets the needs of the current generation without compromising the ability of *future generations* to meet their own needs"

Sustainability develops along different axes



Tomorrow

"Breeding for the highest number of 1st Quality Eggs per hen housed!"

Selecting for

- Persistency
- Robustness
- Egg shell Quality
- Livability
- Optimal Curves
- Footprint
- Behavior
- Targeted genetic engineering?

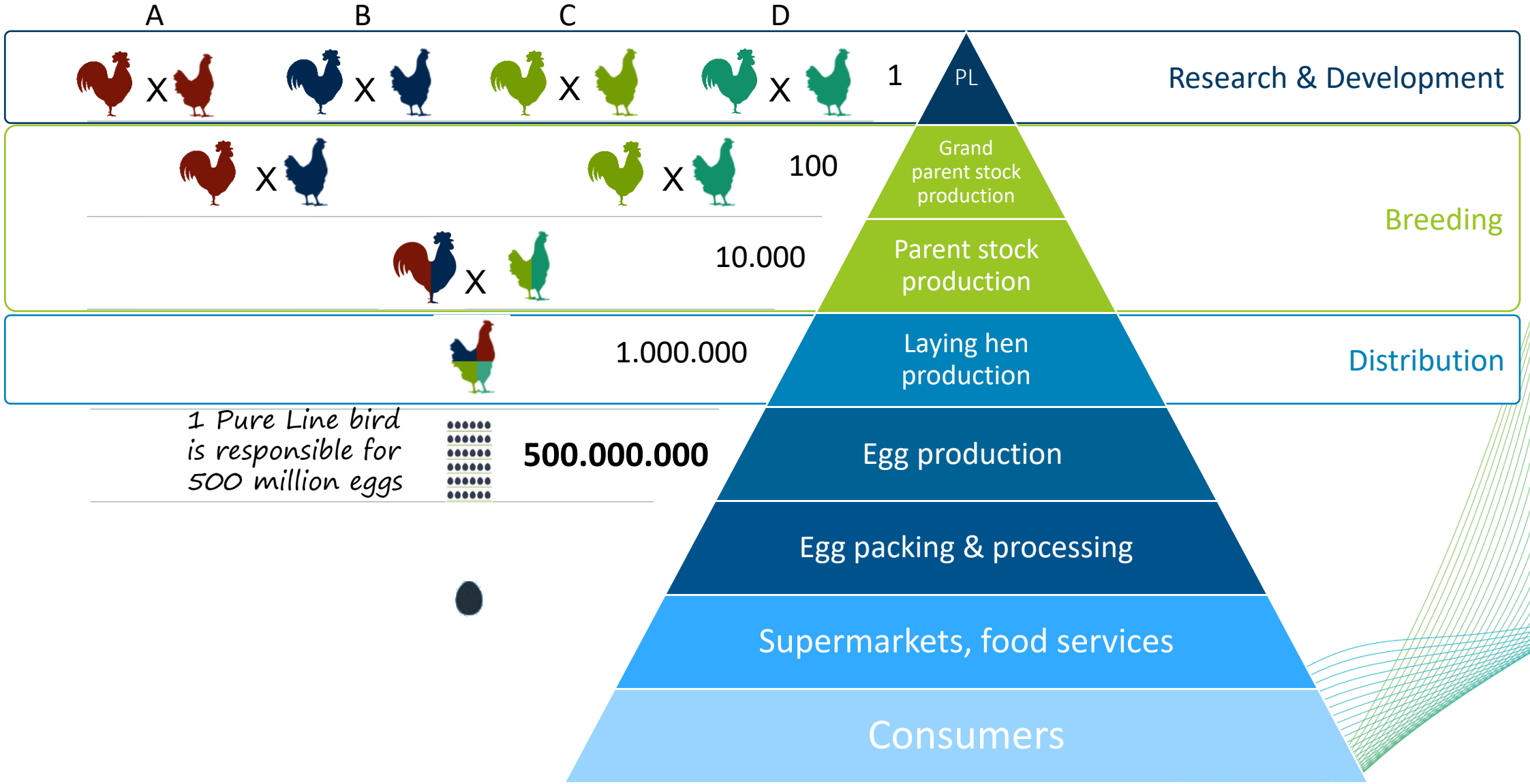

Egg quality
Internally
Externally
Shell colour
Dry matter
Taste
Robustness
Liveability
(social) Behaviour
Adaptation
Feather cover
Resistance
Reproduction
Fertility
Hatchability
Chick quality
7 day mortality
Productivity
Early maturity
Peak production
persistency
Physiology
Feed intake
Feed conversion
Pullet development
Body Weight curve
Egg weight curve
Bone health
Today
“Breeding for the highest amount of 1st Quality Eggs per hen housed!”



Fulfilling global needs and consumer wishes

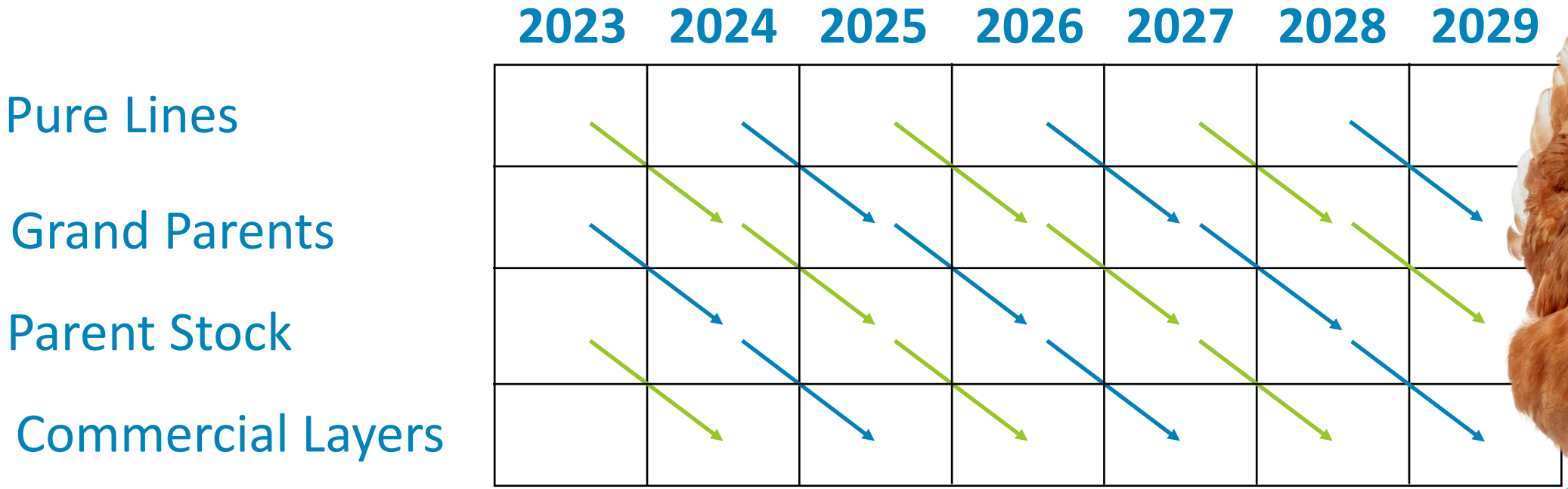


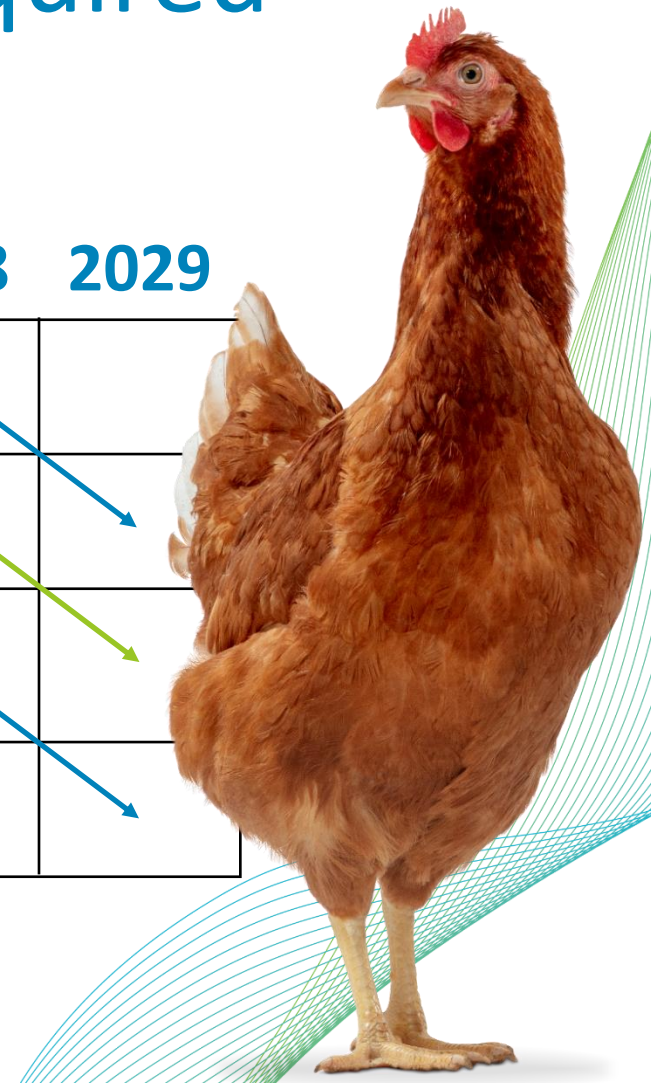
The egg production supply chain



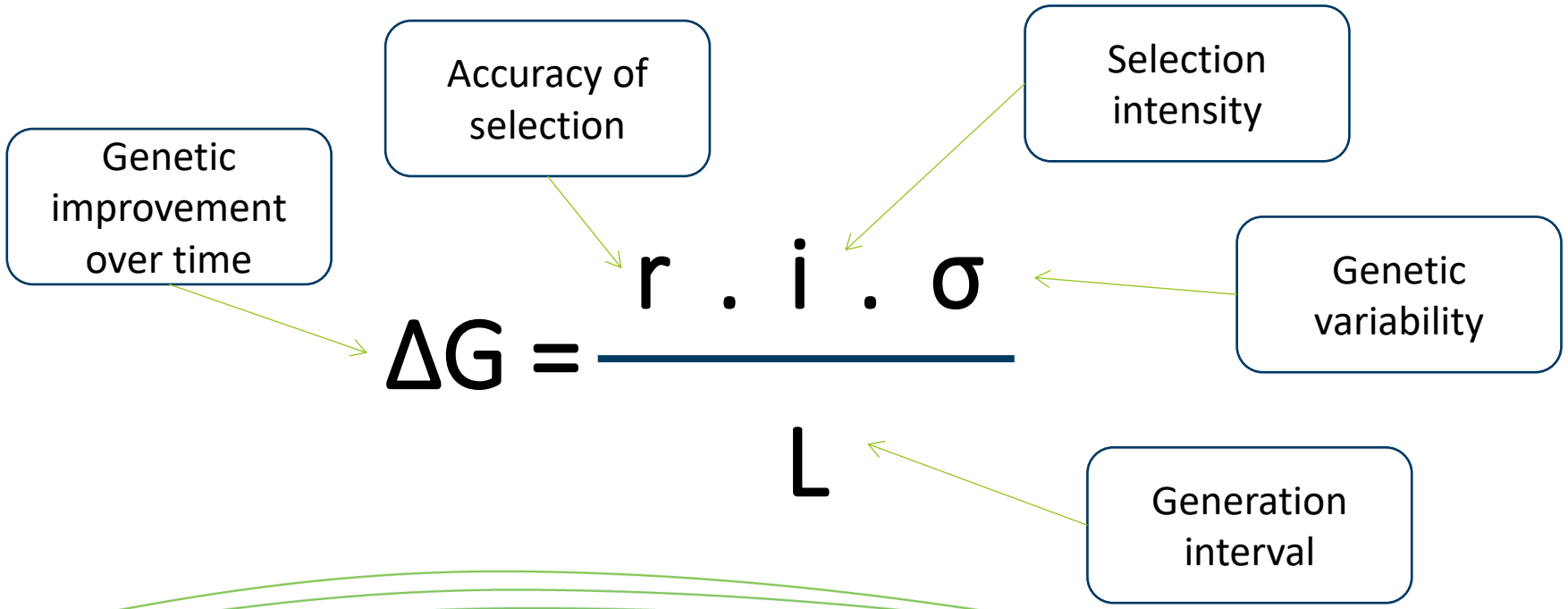
Long-term view of production and market requirements is required

Time frame of the breeding cycle





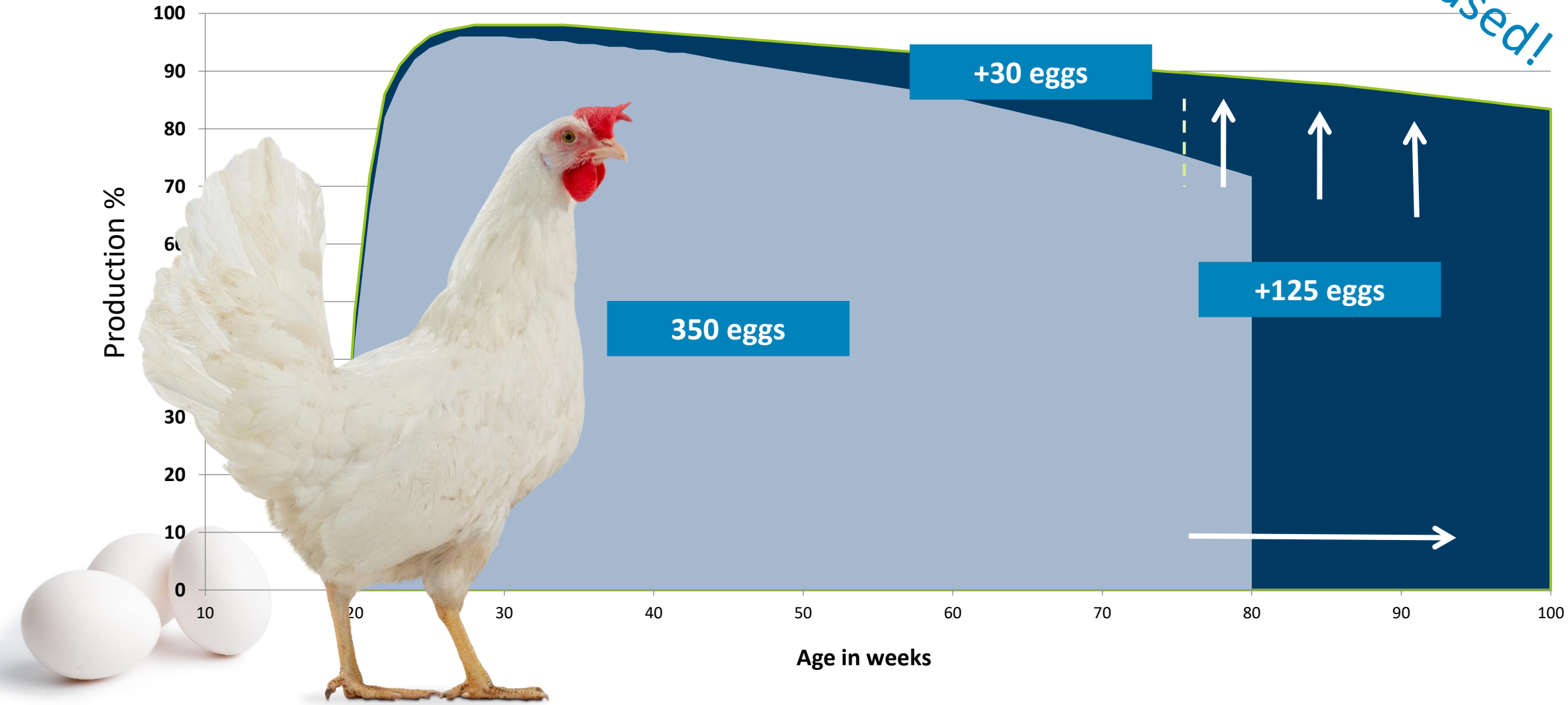
Finding the right Balance

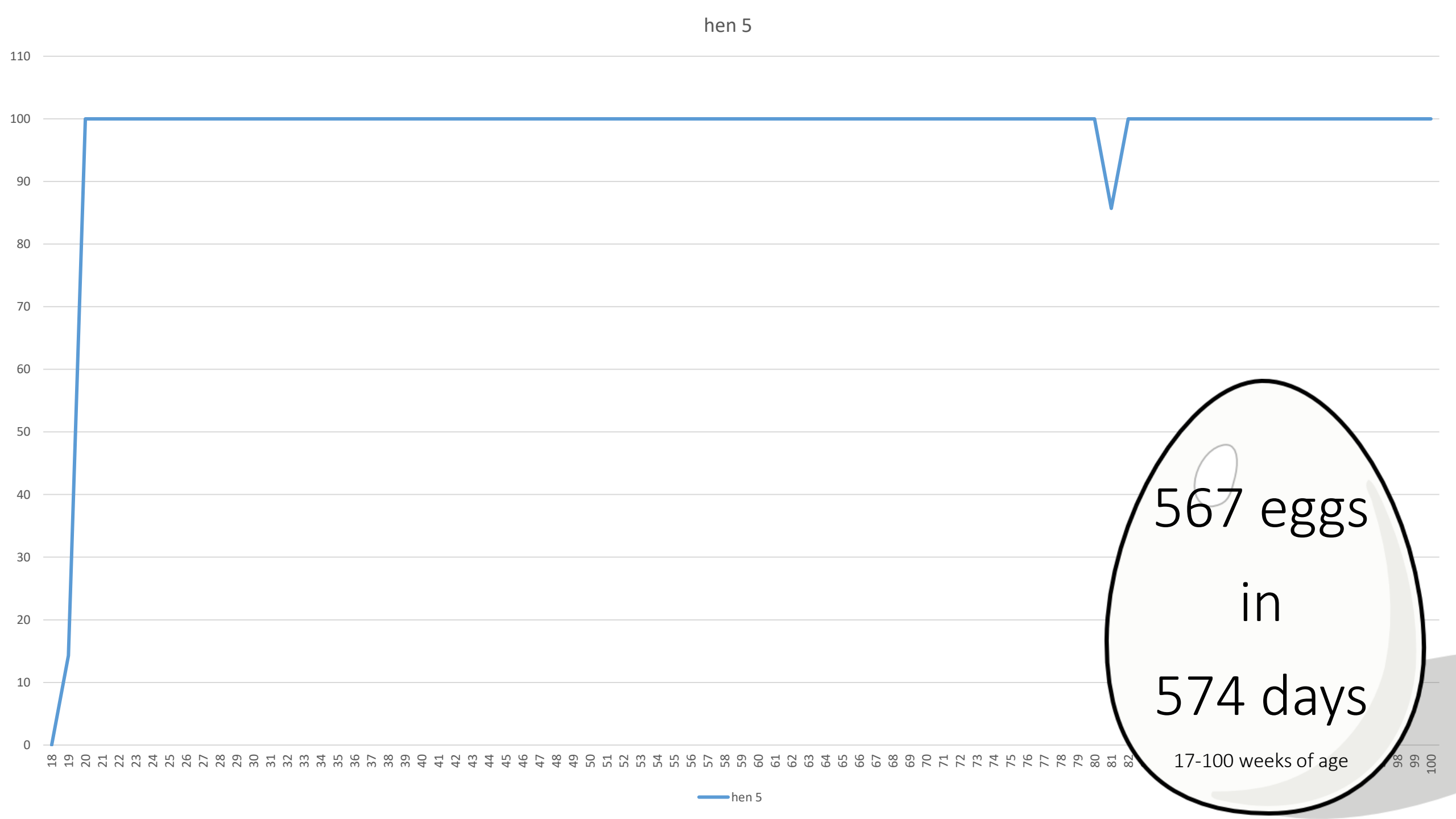


Genetic Progress:

Higher production and longer laying cycles

505 eggs per hen housed!




hen 5
110
100
90
80
70
60
50
40
30
20
10
0
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 98 99 100
hen 5
567 eggs
in
574 days
17-100 weeks of age

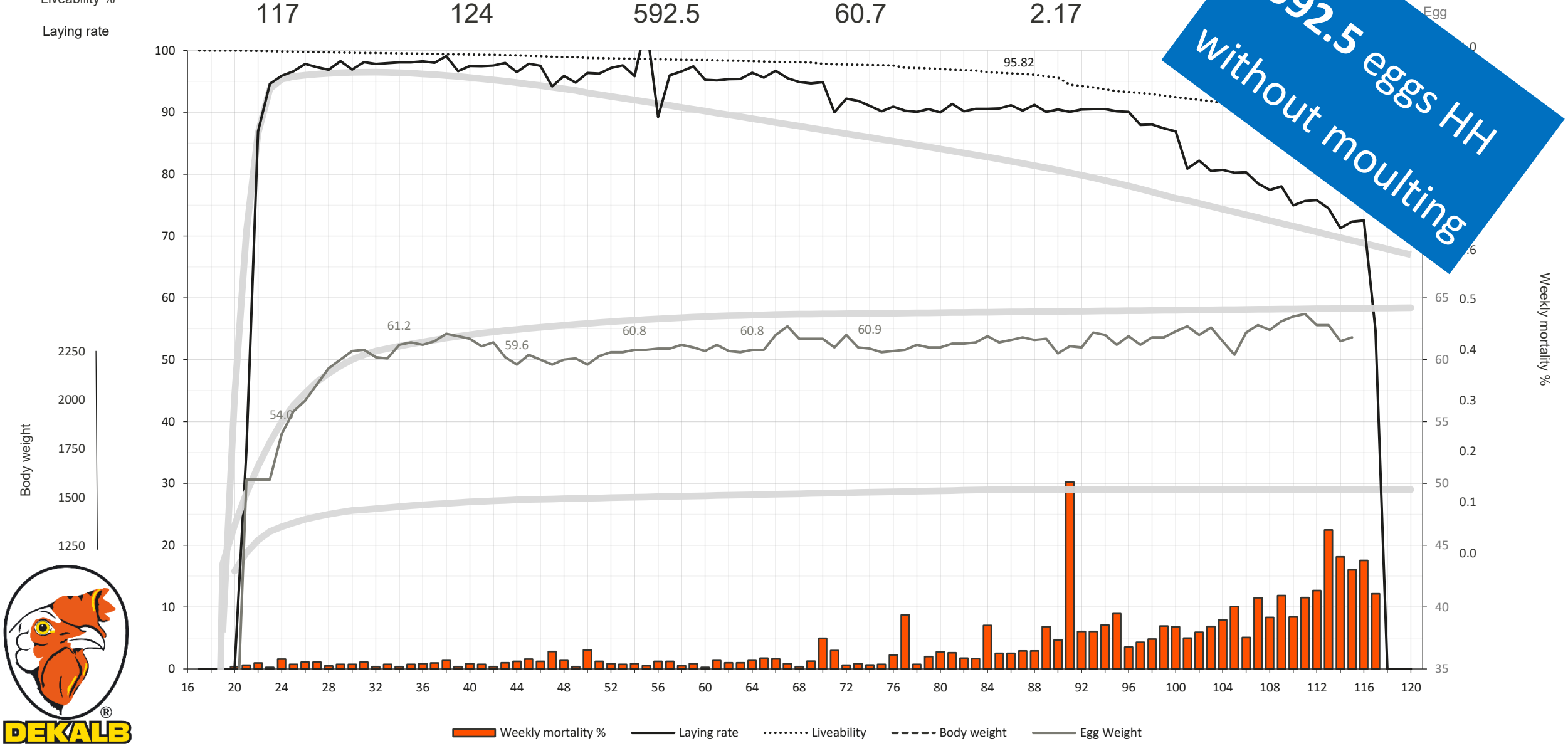
Farm
House number 3
Housing system Organic

Laying performances

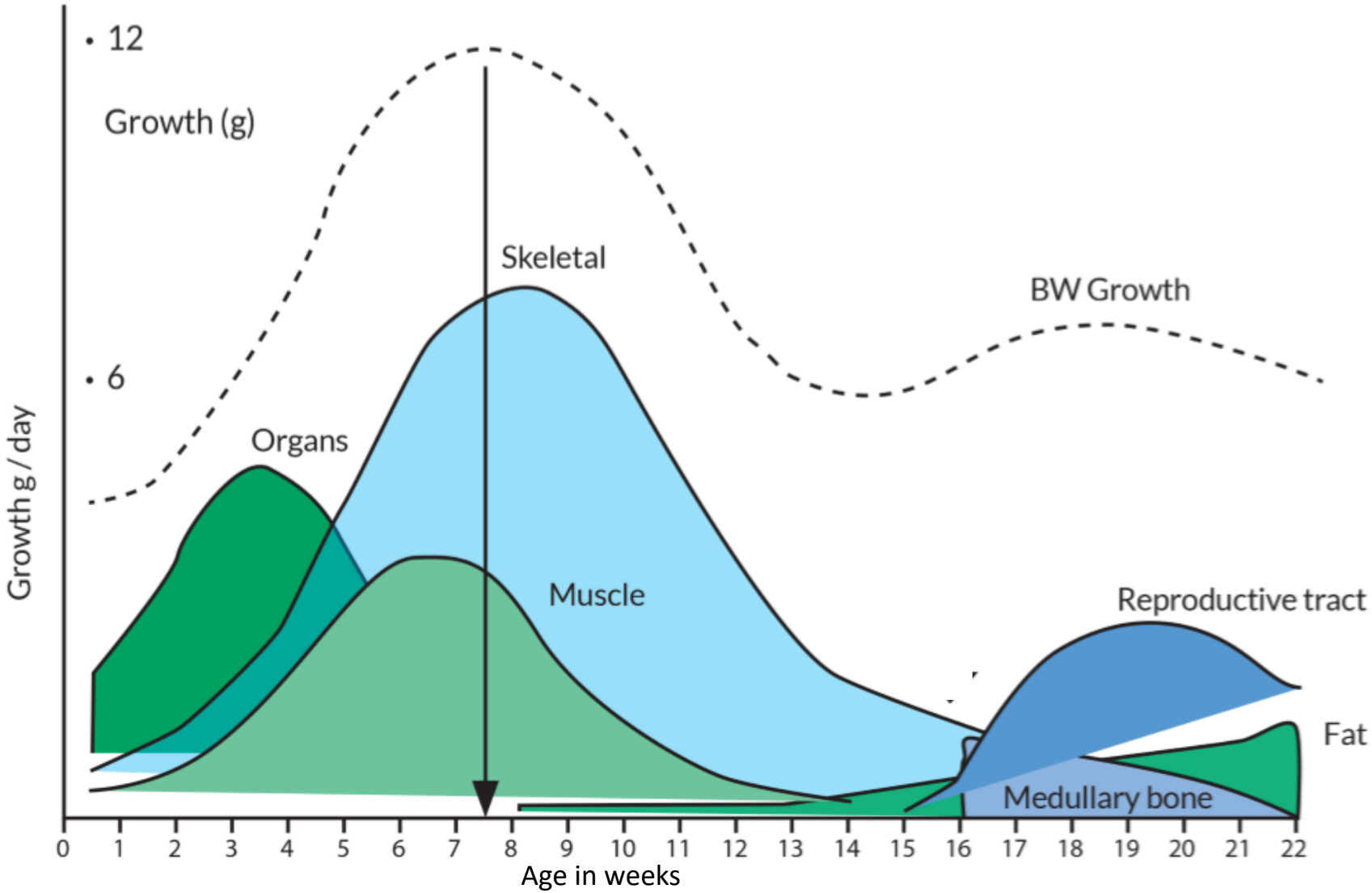
Hatch date 09/02/2021
Breed DEKALB WHITE
Birds housed 20,575

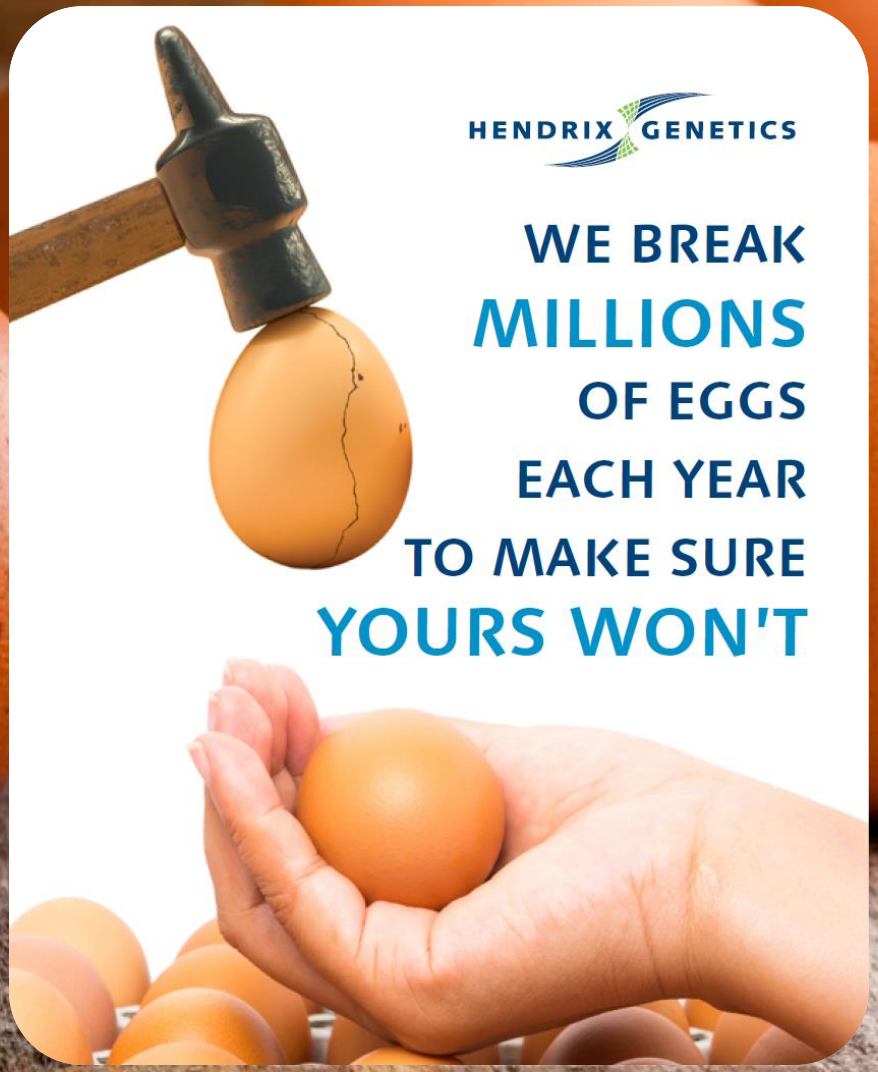
Week	Cum feed cons	Egg/hh	AEW	FCR
117	124	592.5	60.7	2.17

592.5 eggs HH without moulting



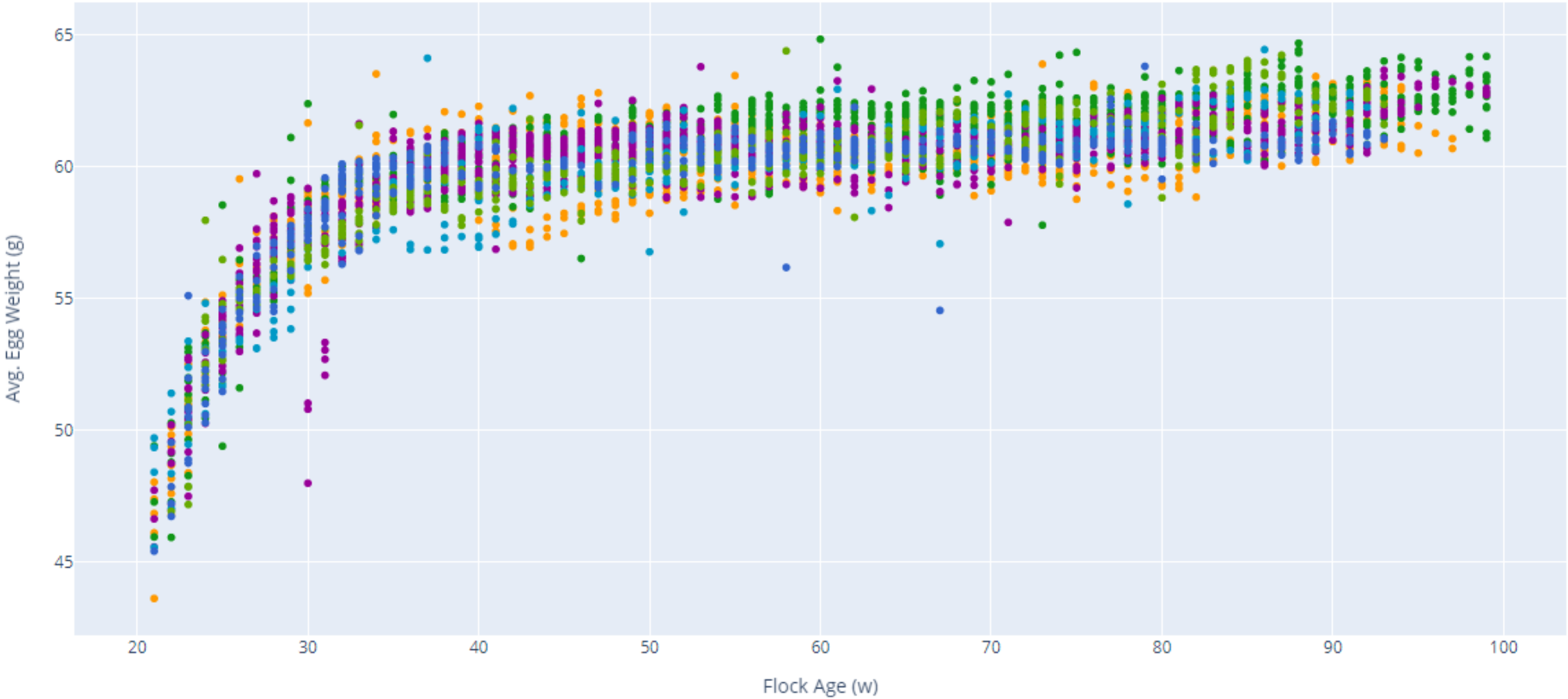
Increased Focus on Pullet Development





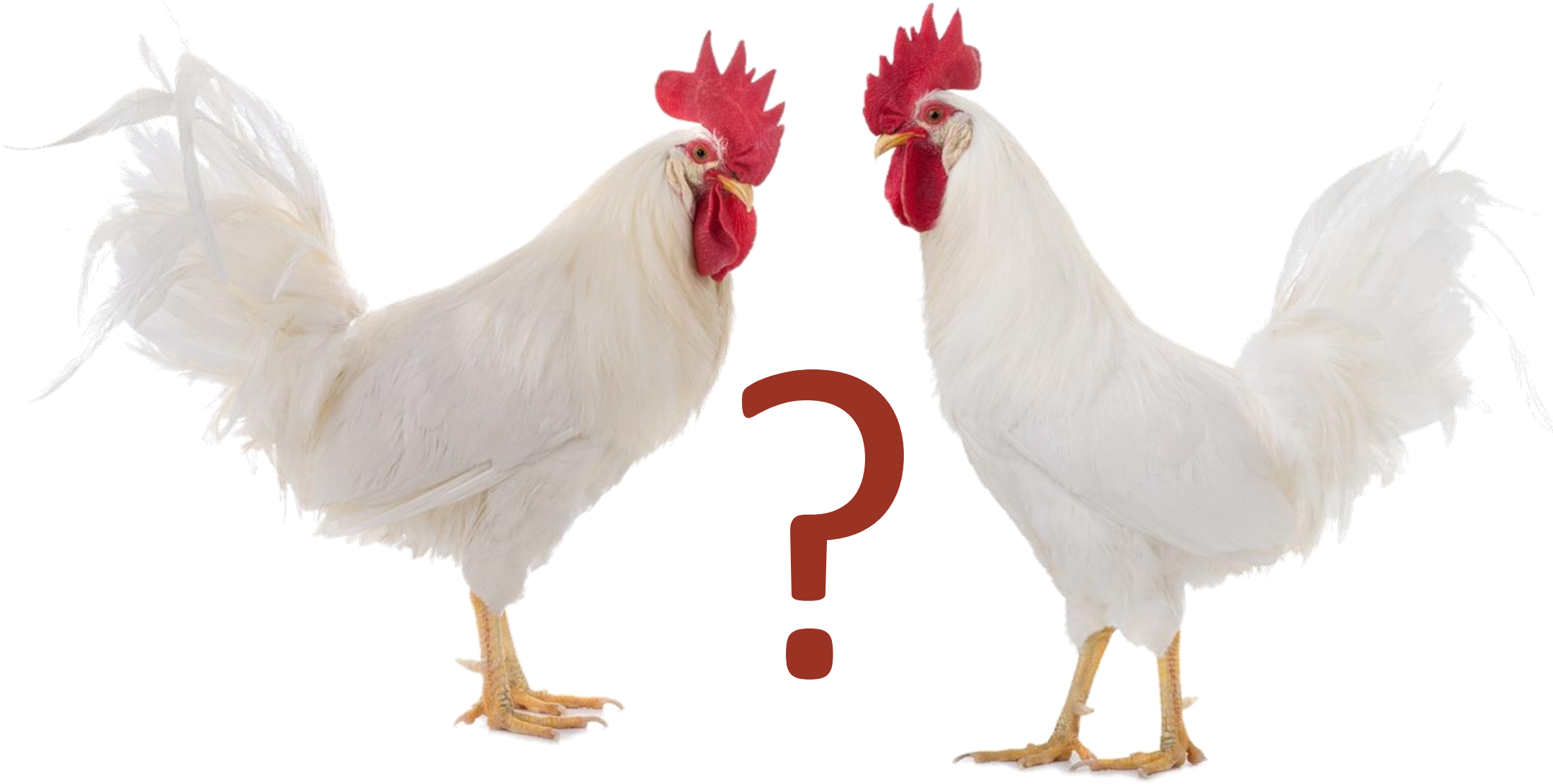
Focus on 1st Quality from the inside: selection against blood and meat spots

Flatten the Curve

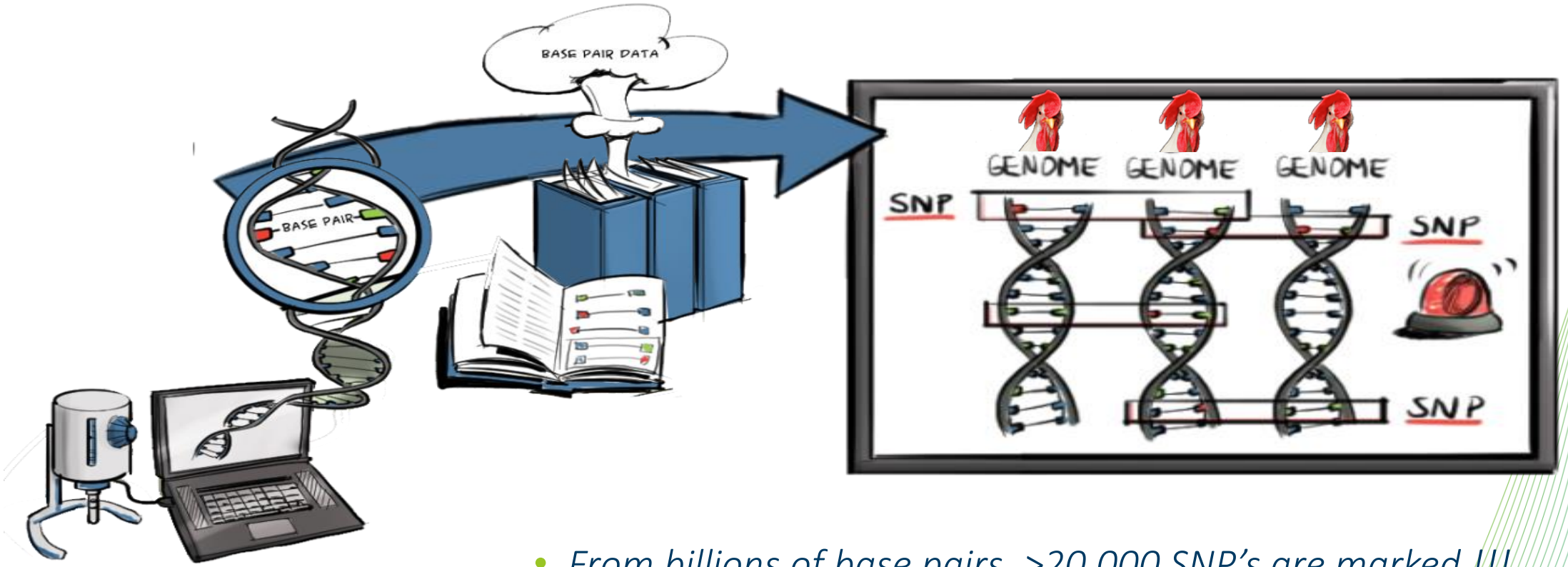


Increasing interest in “specialty” eggs

2 Full Sib Brothers



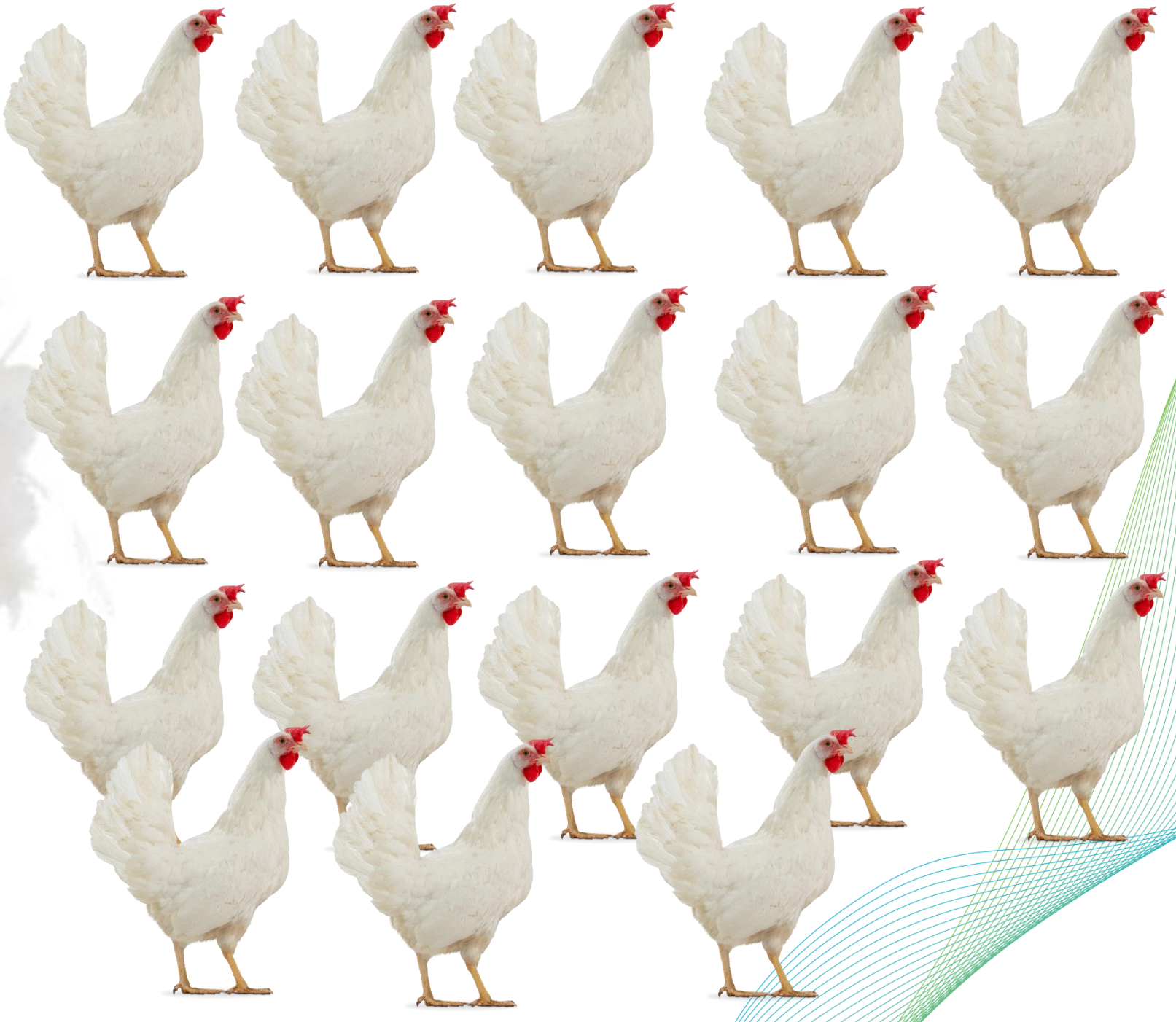
Genomic information



- *From billions of base pairs, >20.000 SNP's are marked !!!*

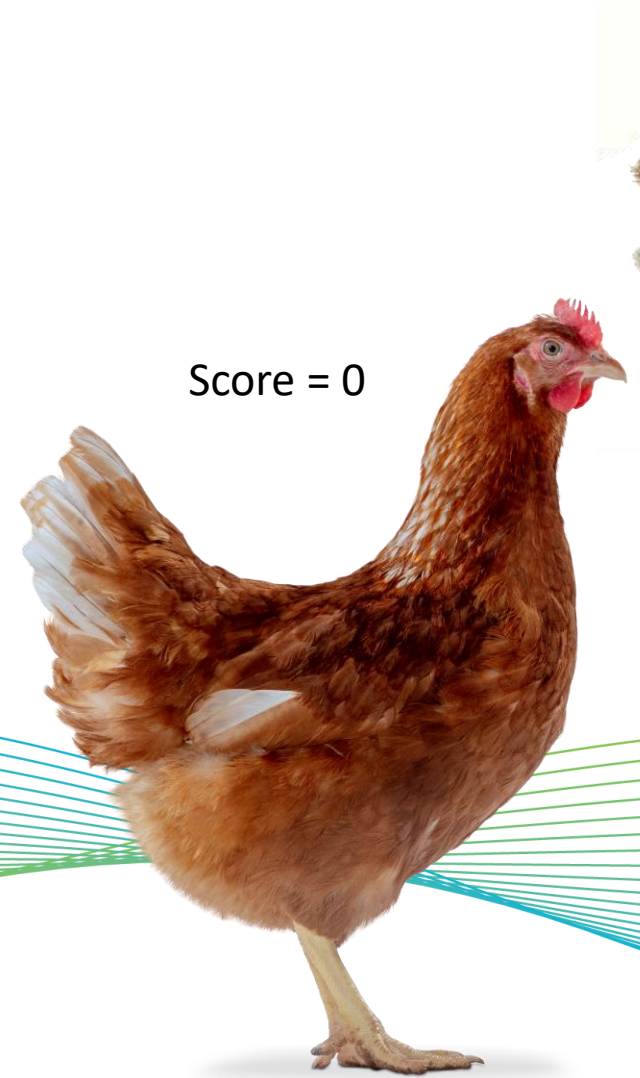
- More + faster genetic progress
- Higher accuracy at young age

Sire testing



Field Testing

Focus on liveability



Score = 0

Score = 1

Score = 2

Pictures derived from www.Featherwel.org

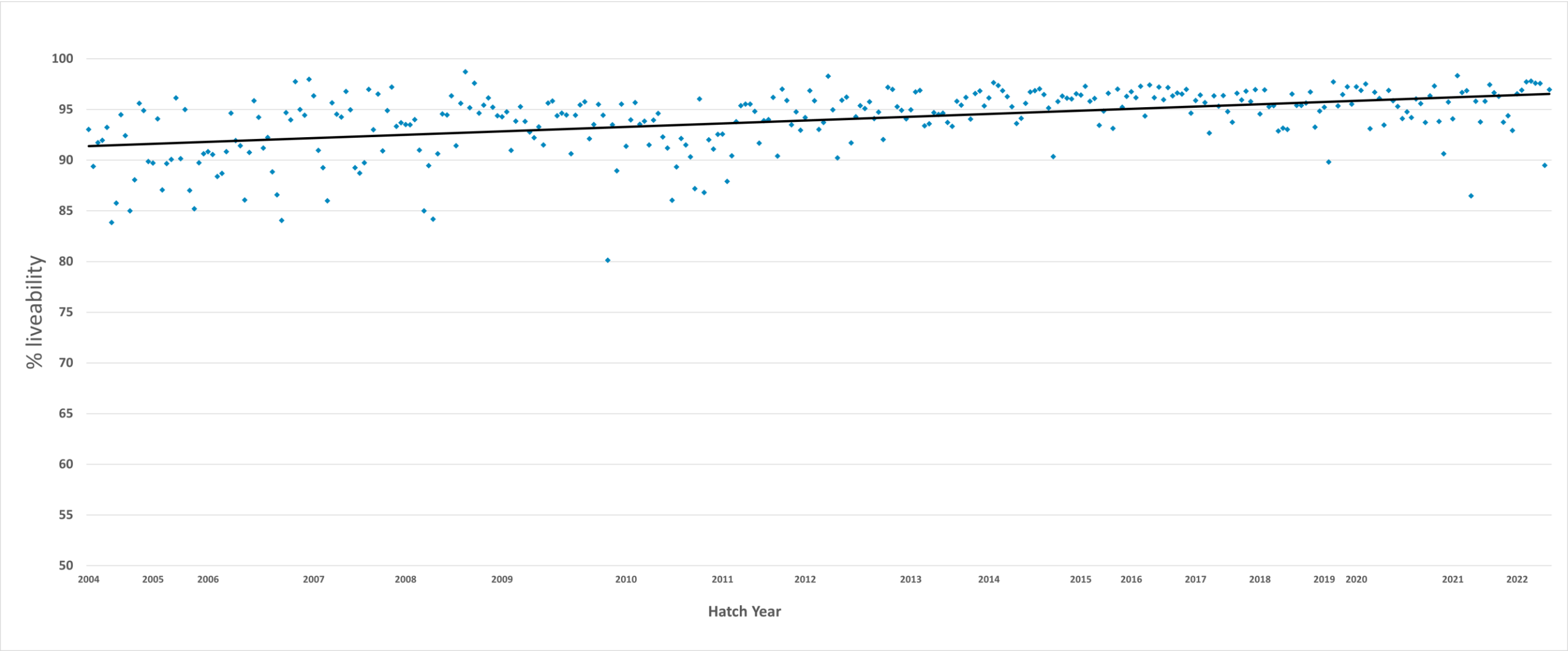
Livability: breeding a “social” hen

Challenging the birds via their environment

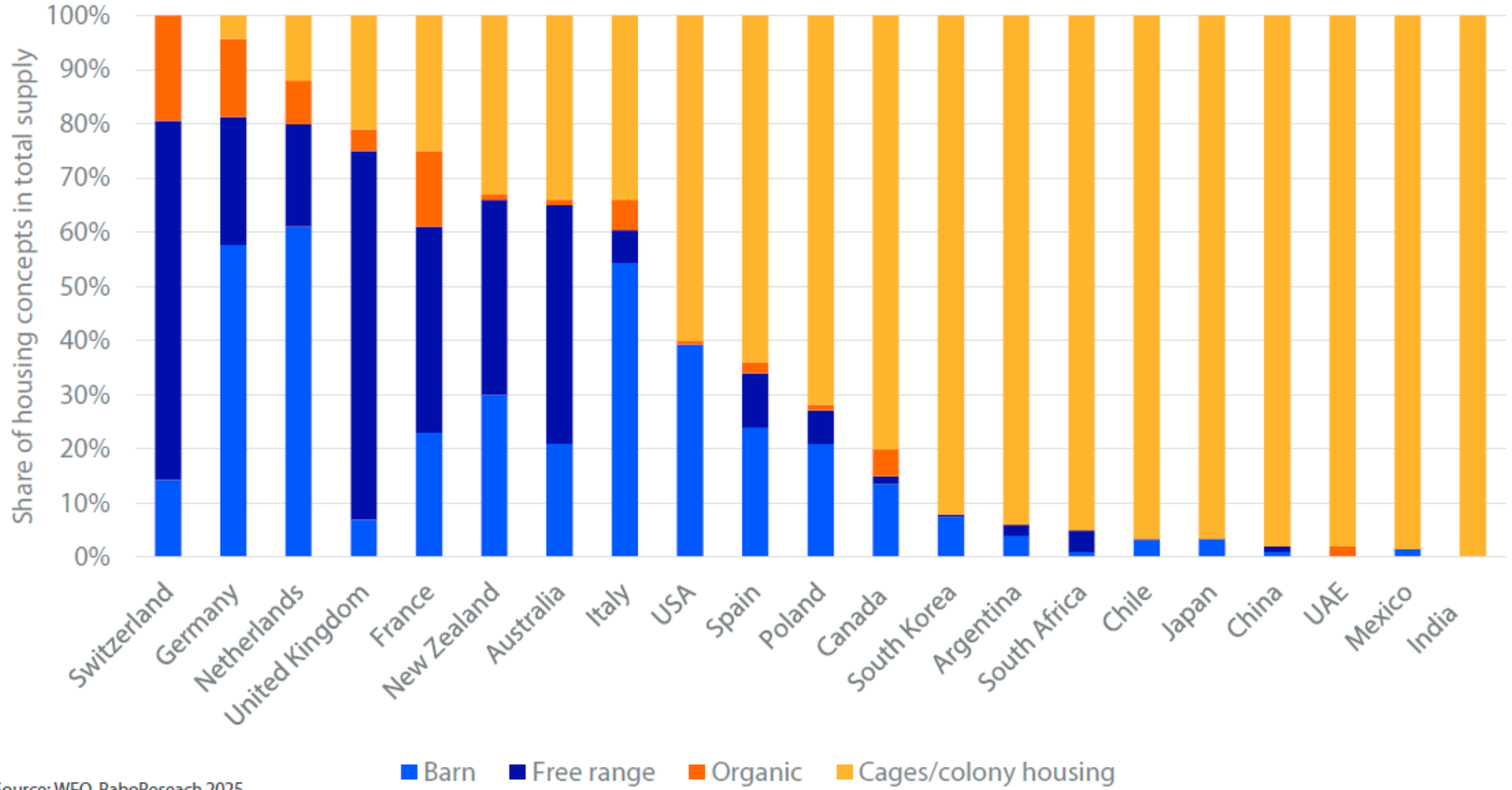
- Higher bird density per cage
- Higher light intensity
- Intact beaks

Goal: to identify the “friendly” families with good productionand use them as parents for future generations

Many small steps do make big impact

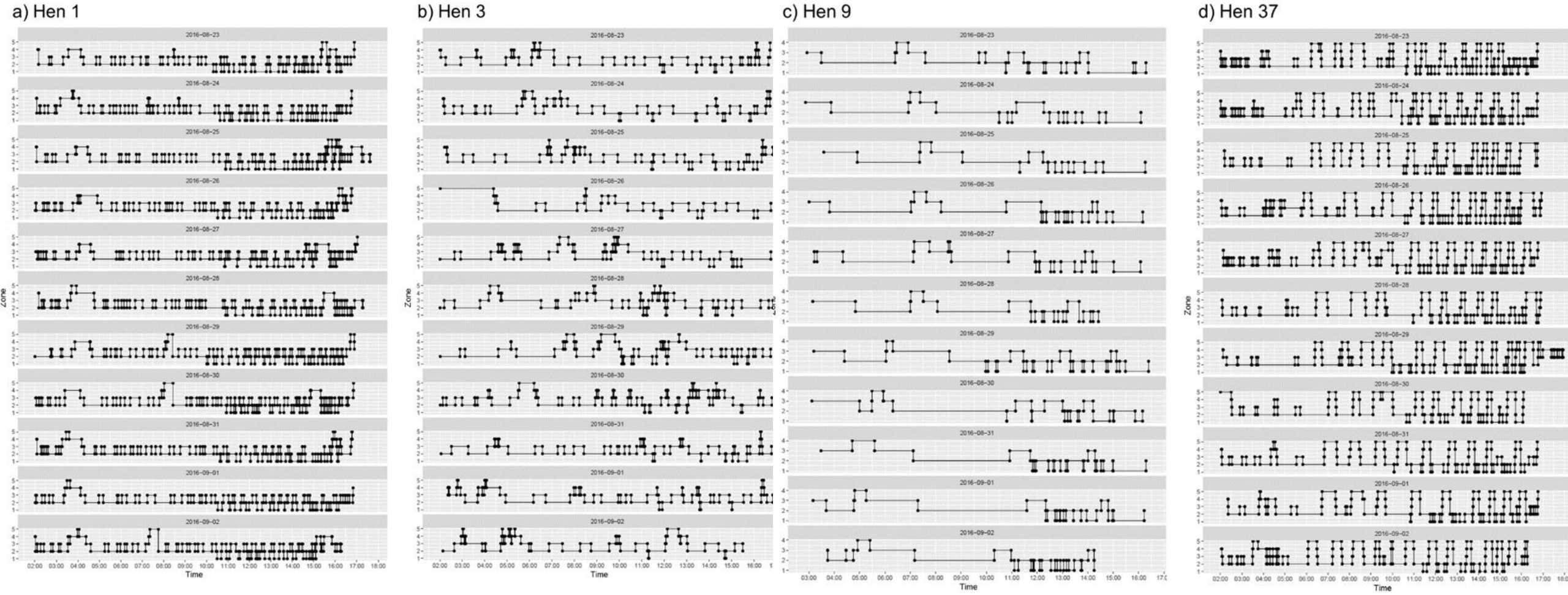


Cage-free egg production further on the rise

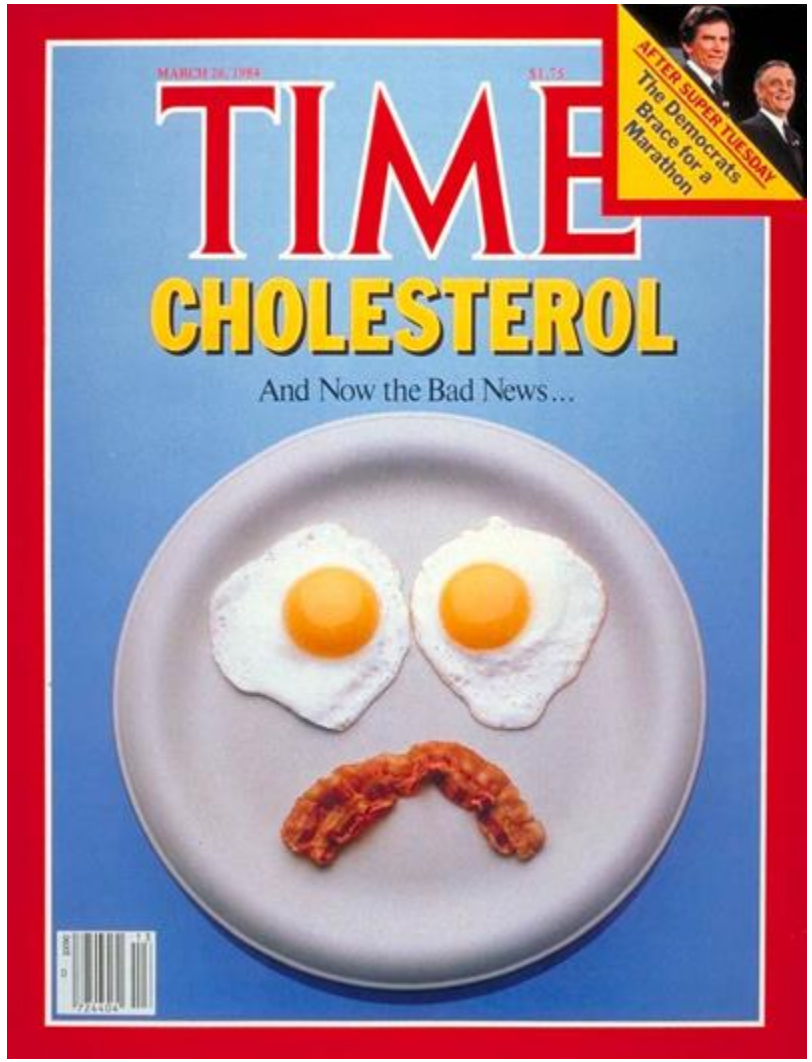


Source: WEO, RaboReseach 2025

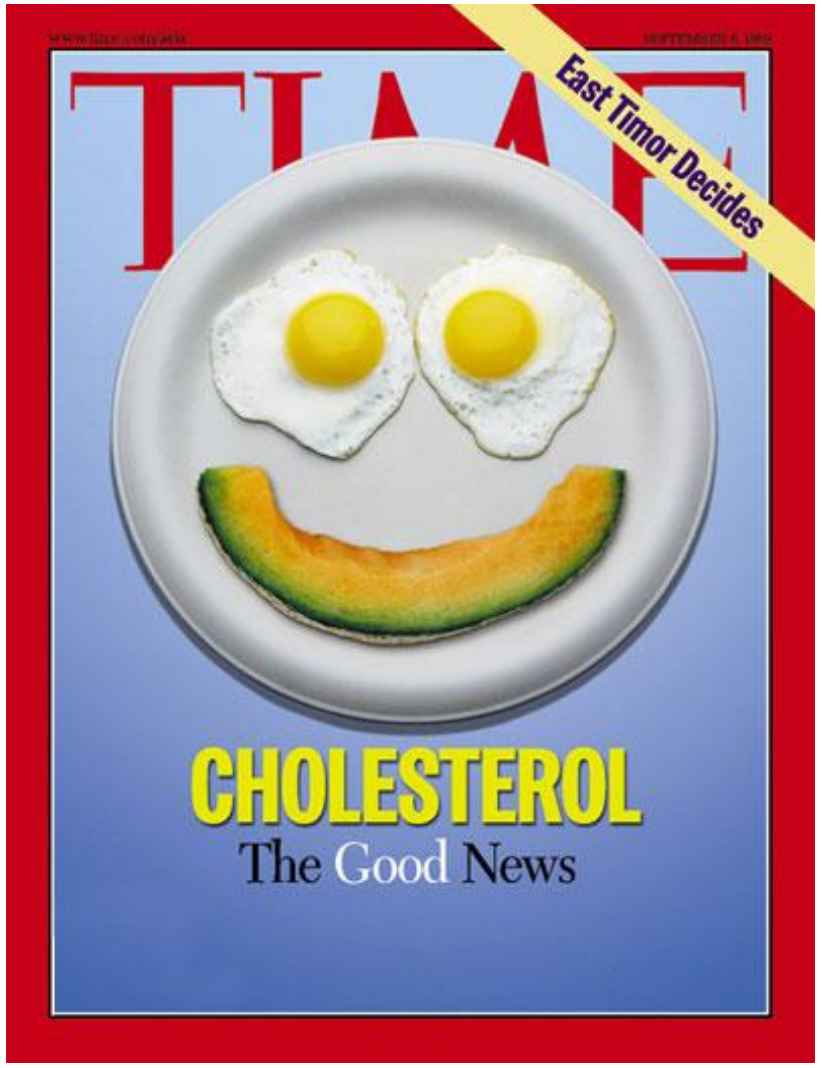
Clear differences in movement patterns



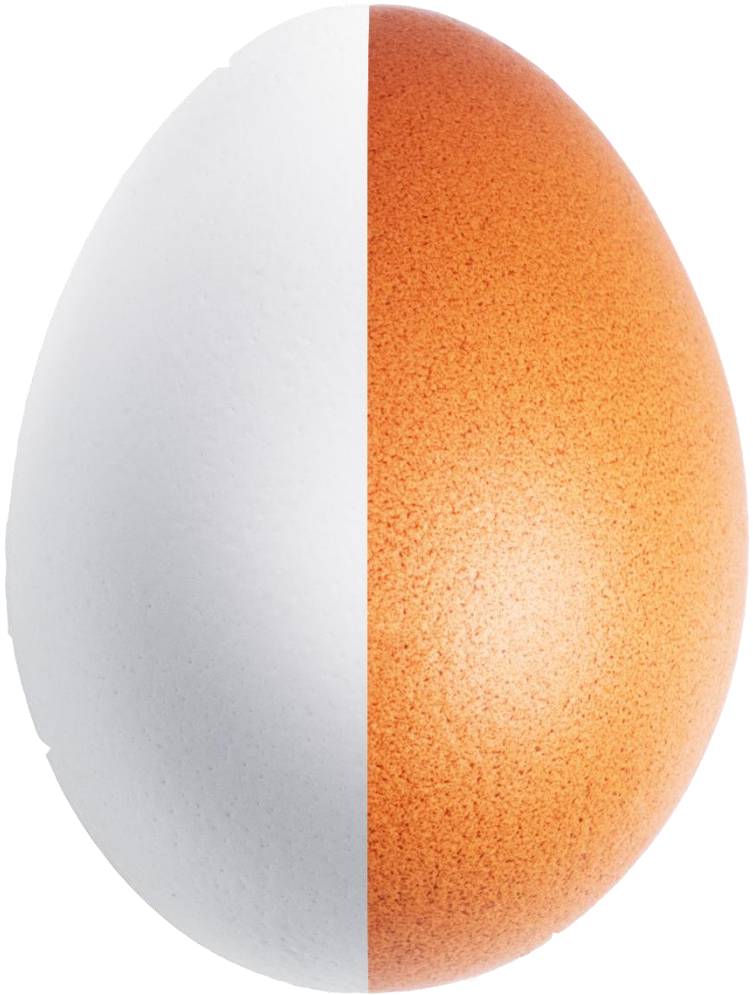
1984


TIME
CHOLESTEROL
And Now the Bad News...
AFTER SUPER TUESDAY
The Democrats Brace for a Marathon

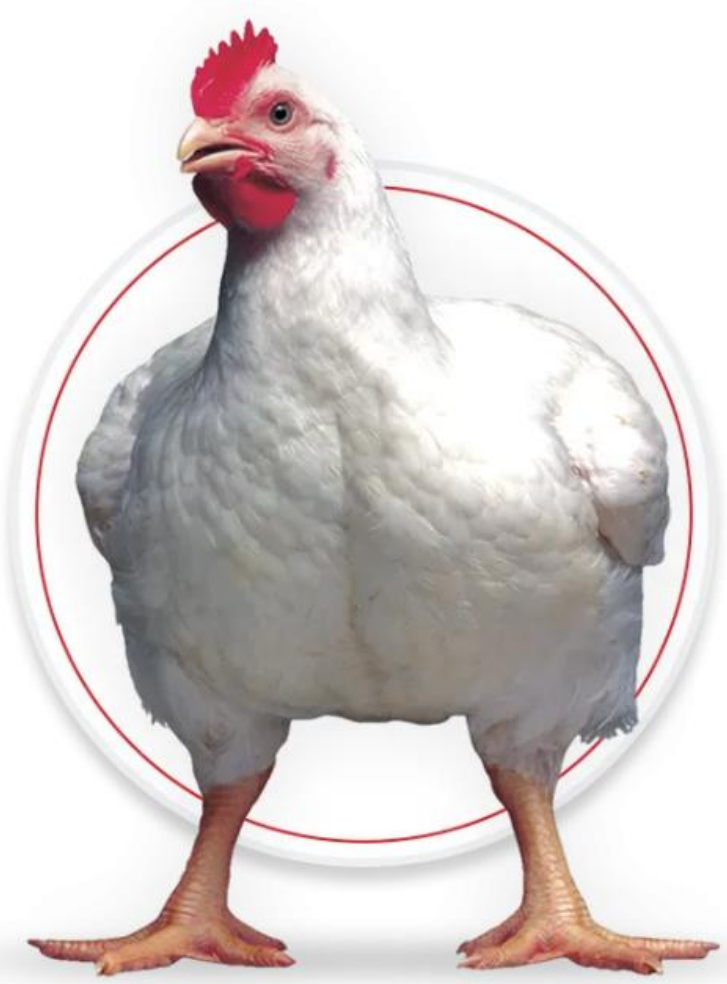
1999

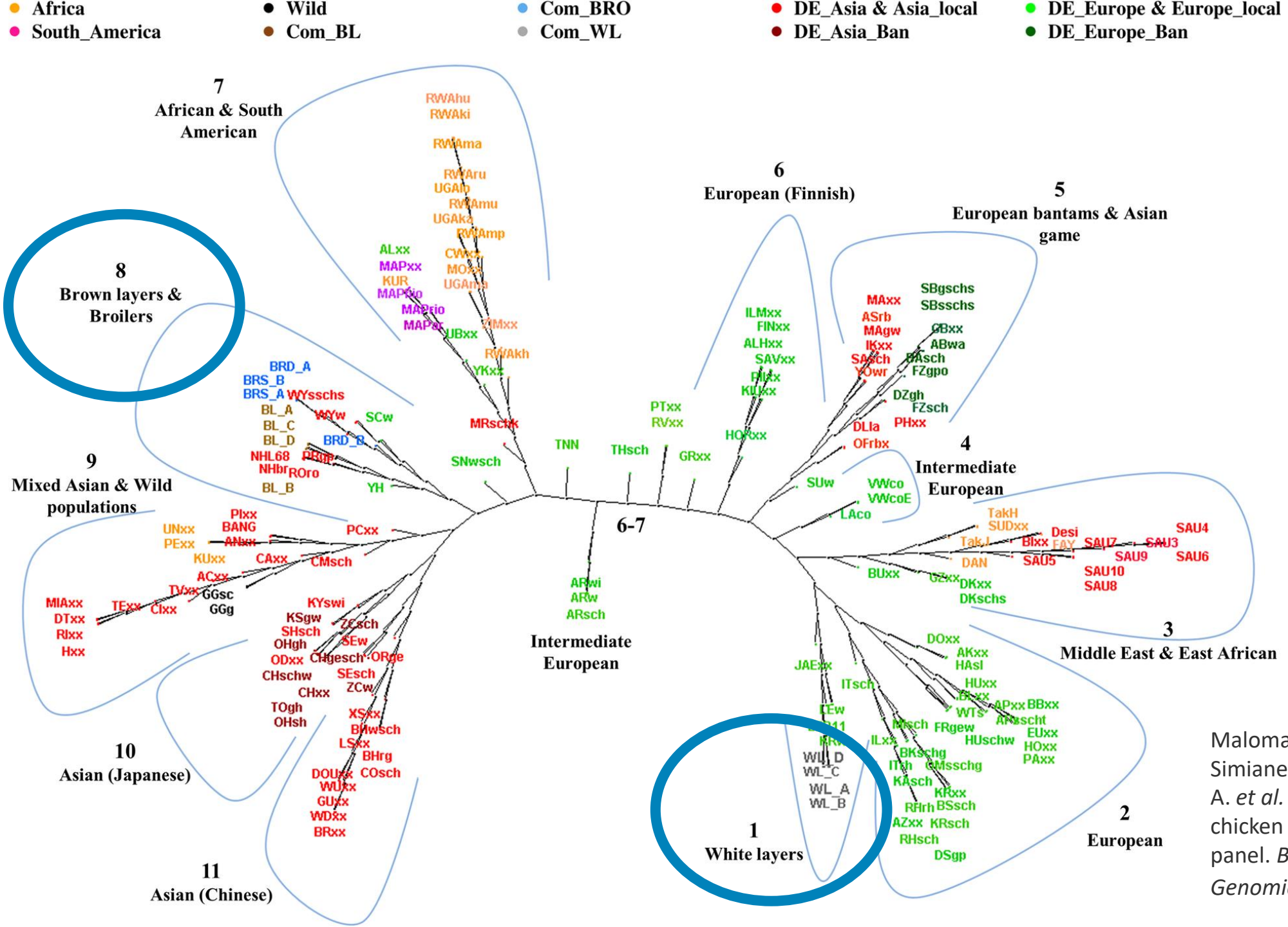

East Timor Decides
CHOLESTEROL
The Good News

“An egg is an egg”



But not every Chicken is the same Chicken





Malomane, D.K., Simianer, H., Weigend, A. *et al.* The SYNBREED chicken diversity panel. *BMC Genomics* **20**, 345 (2019)

Carbon Footprinting

Kg CO_2 per kg of eggs	Brown laying hens	White laying hens
90 weeks of age	2.06	1.95
100 weeks of age	2.06	1.93

A difference of 6,33%

CARBON FOOTPRINTING ASSESSED BY EGGBASE

Shell egg color: Gradual shift to more white eggs

Global preferences in egg color differ; these are gradually changing

Figure 31: Global egg market by color, 2000-2035f

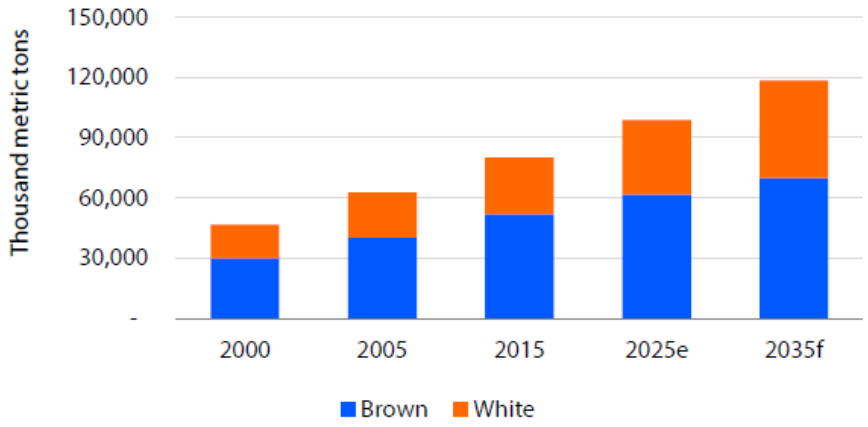


Figure 32: Global egg market by color and country, 2024

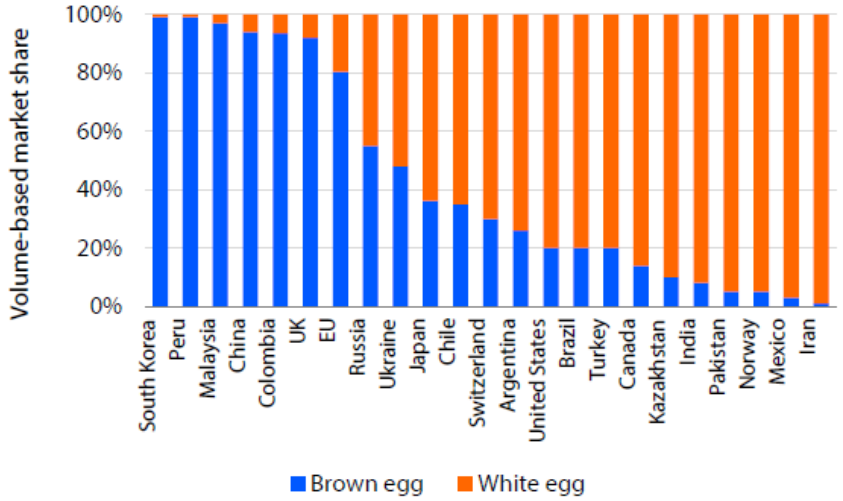


Figure 33: Key drivers of color preference

- ***Tradition/culture***
- ***Product image (color)***
- ***Supply***
- ***Pricing***
- ***Environment***

Egg color: Global differences, white eggs gain market share

One of the most noticeable distinctions in egg consumption is color preference (see figure 32). While brown and white eggs dominate most markets, some countries, like China, also have pink eggs, a hybrid of the two, making up nearly 50% of the local market.

Preferences are shaped by health beliefs, production methods, and farming traditions (see figure 33). For example: South Korea prefers brown eggs, while Japan prefers white eggs; the EU and UK traditionally prefer brown eggs, while the US, Canada, and Australia prefer white eggs.

White egg market share is expected to rise globally – from 37% in 2025 to over 40% by 2035 (see figure 31). In countries like the Netherlands and Germany, there is an ongoing shift from brown to white eggs due to cost and environmental benefits. Some retailers promote white eggs to reduce their carbon footprints.

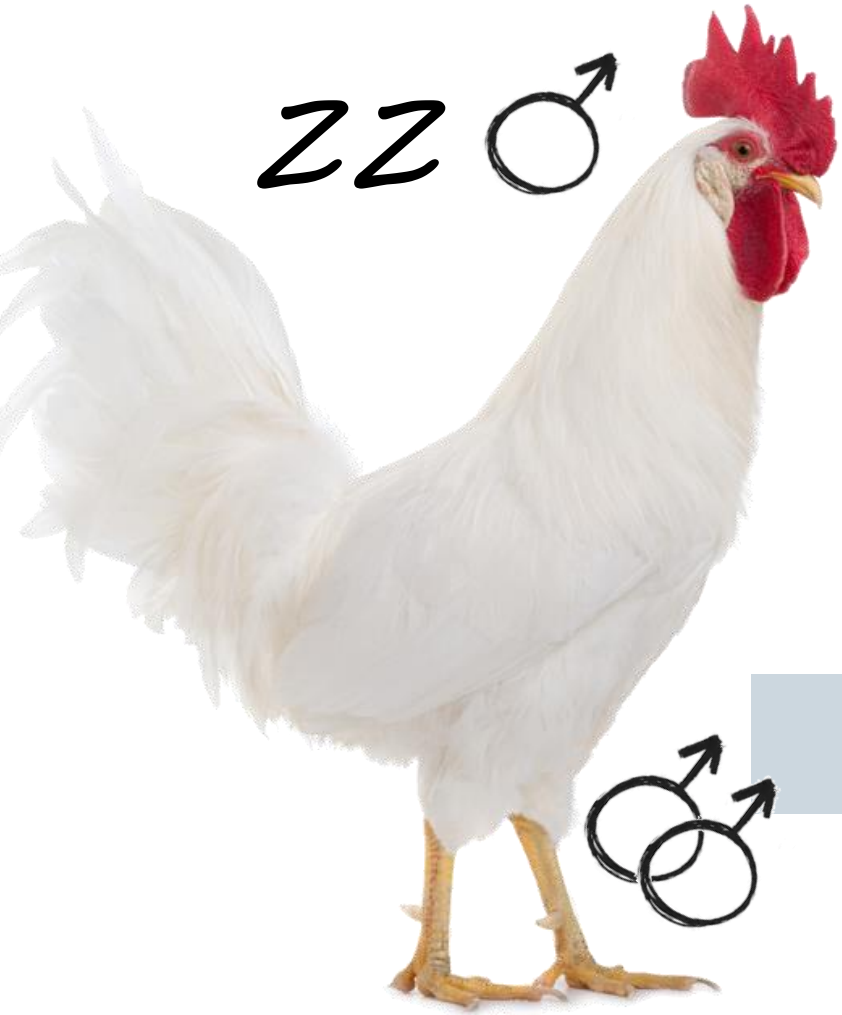
Future growth in the white eggs segment predicted

***Note:** Several countries, like China, have also a category of pink or red eggs, which is approx. 50% of the market.*
***Source:** RaboResearch estimate and projections based on FAO, WEO, regional statistics, RaboResearch 2025*

Rabobank WEO World Egg Organisation

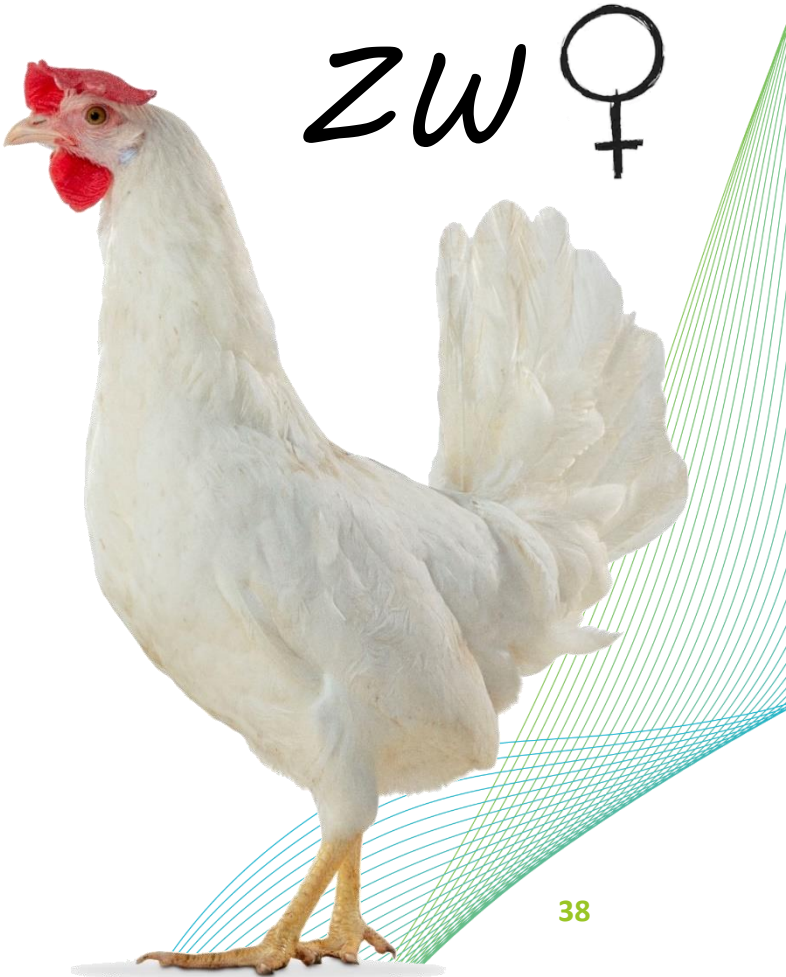
New Genetic Technologies

The cause

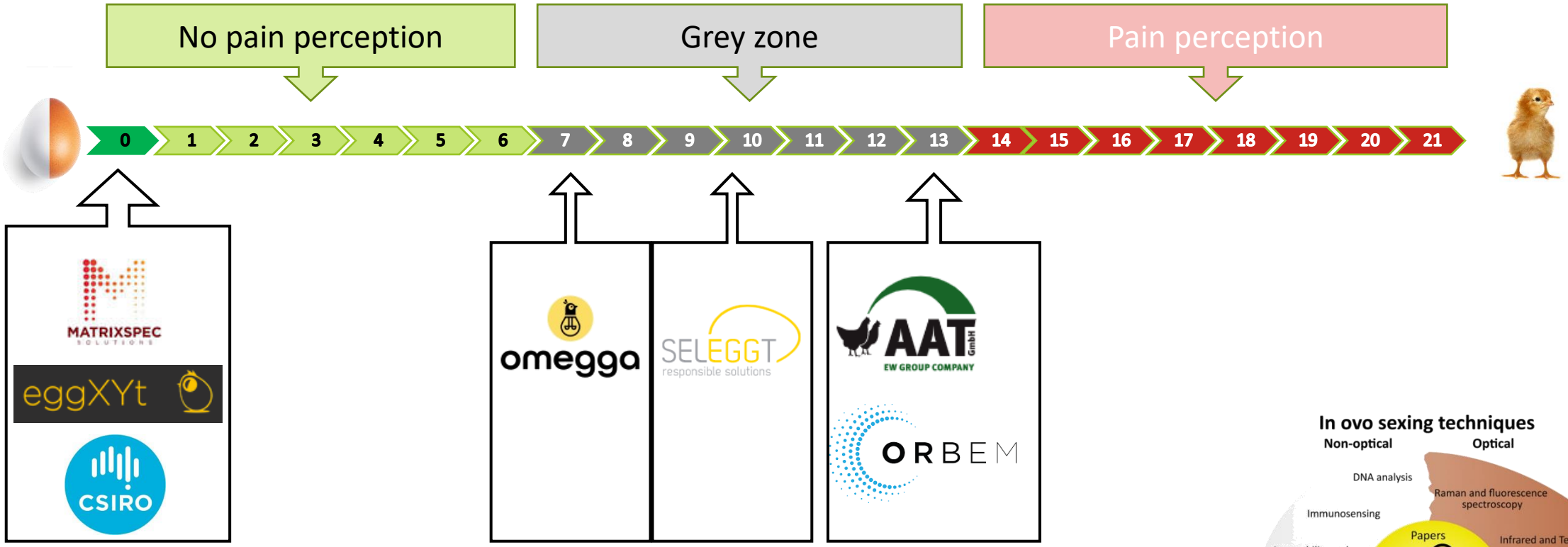


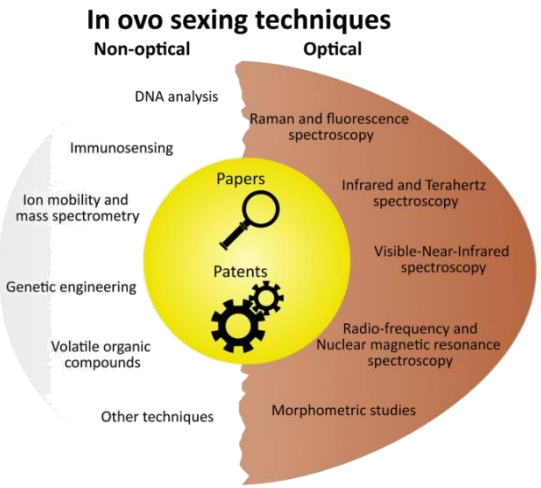
♀♀

	Z	W
Z	ZZ ♂	ZW ♀
Z	ZZ ♂	ZW ♀



Companie active in In-ovo sexing





Update 10-4-2026
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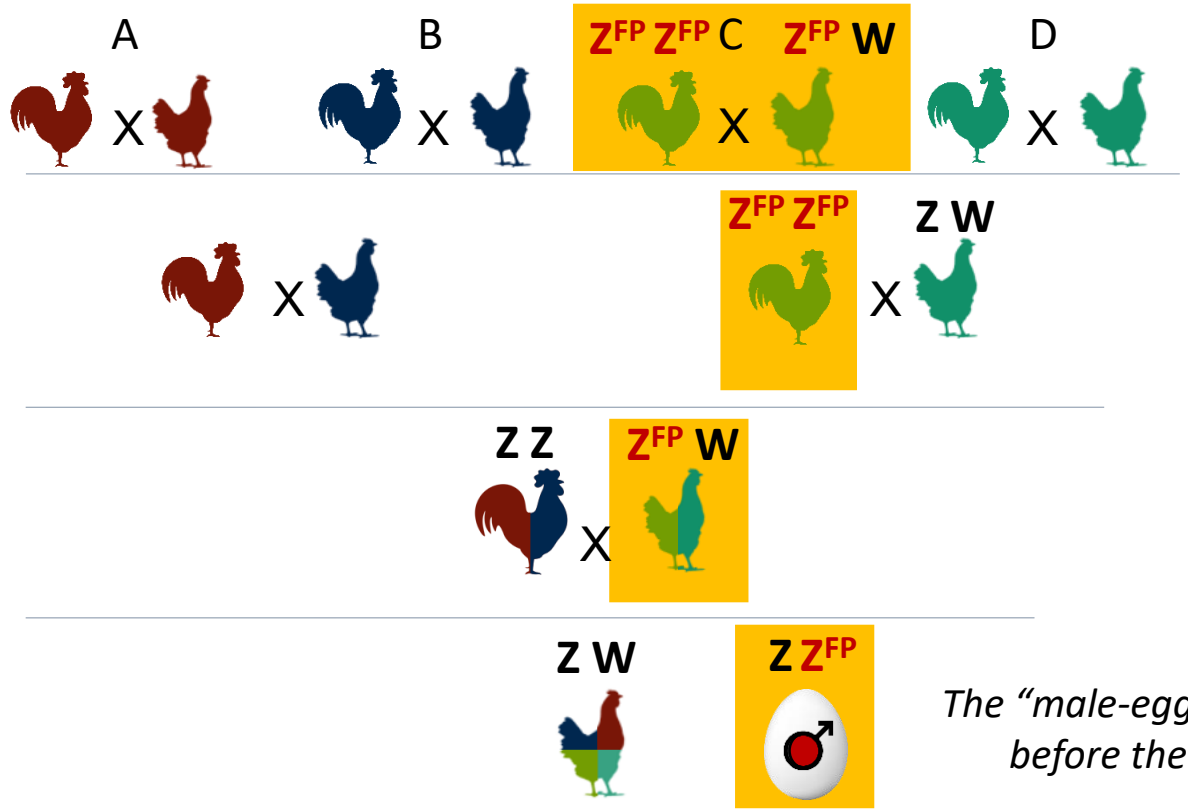
Genetic Engineering developments



Pure Lines

Grand Parents

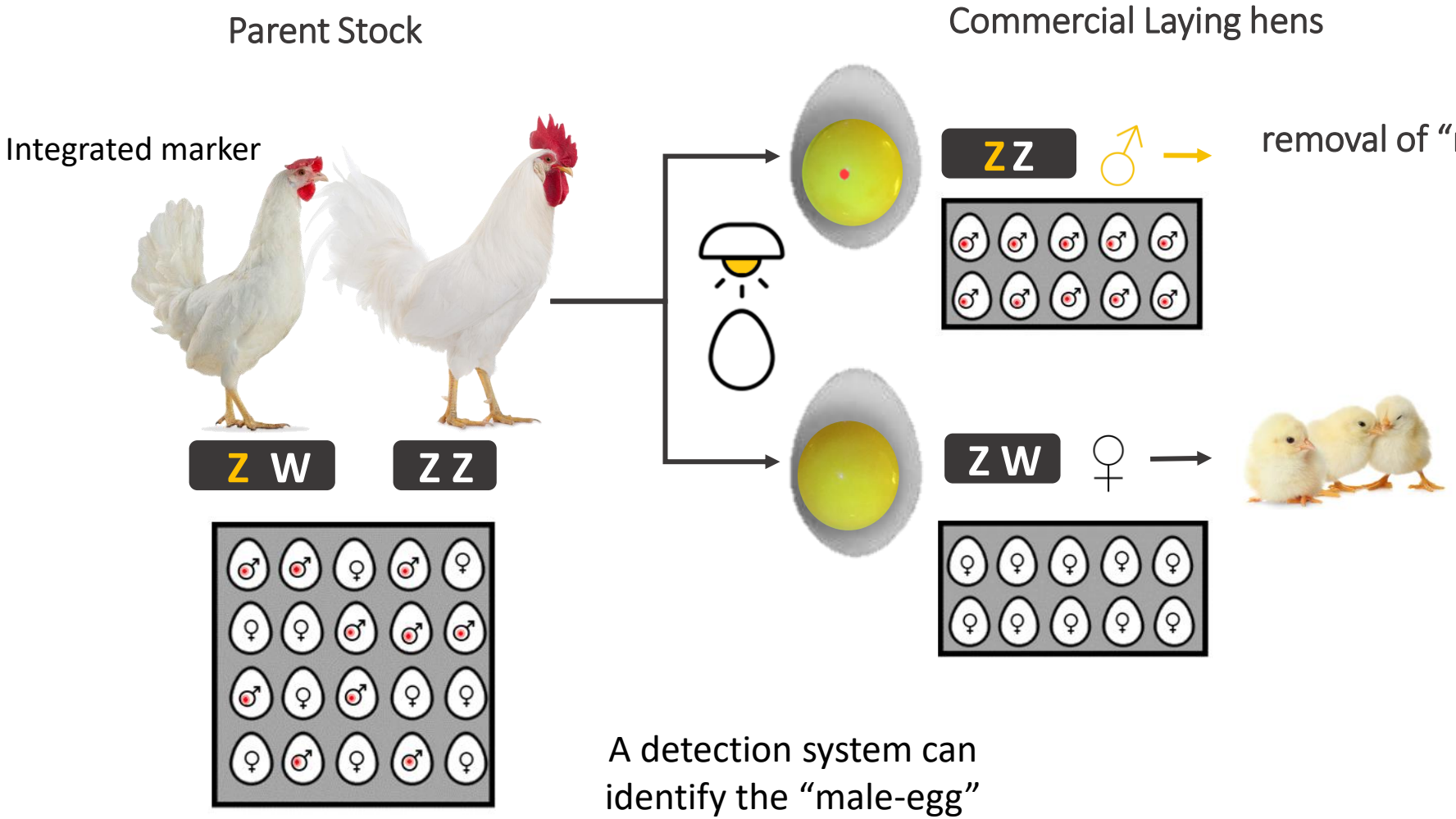
Parent Stock

Commercial Laying hens

The "male-eggs" can be detected, and taken out before the eggs are set in the incubators

Z^{FP} = the newly introduced genetic marker

Detection on day 0 – by inserting a detectable marker on the Z Chromosome



Females born without the culling of male embryo’s or male chicks, + not carrying the integrated marker

Nature's superfood

- *Eggs are among the **most nutritious foods on earth** and are packed with almost all vitamins*
- *Eggs have a **low carbon footprint***
- *Eggs are amongst the **highest value for money** of all animal proteins.*
- *Eggs are **universally accepted** by almost all cultures and religions*

1 egg=
Cheap!

9 essential
amino acids

Rich in
antioxidants

6g
protein

Only 322Kj

NO carbs

Vitamin D +
B12

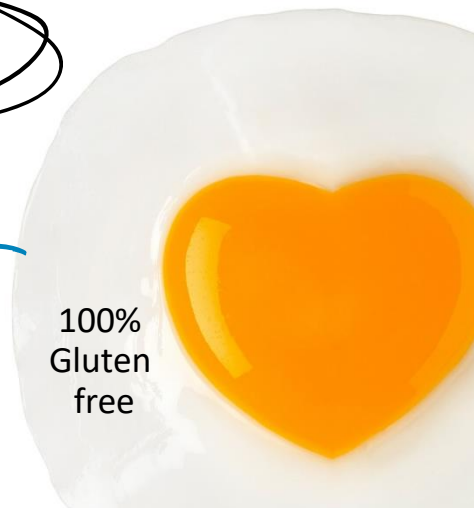
NO sugar

Choline
For your brain
and liver

Cheap!

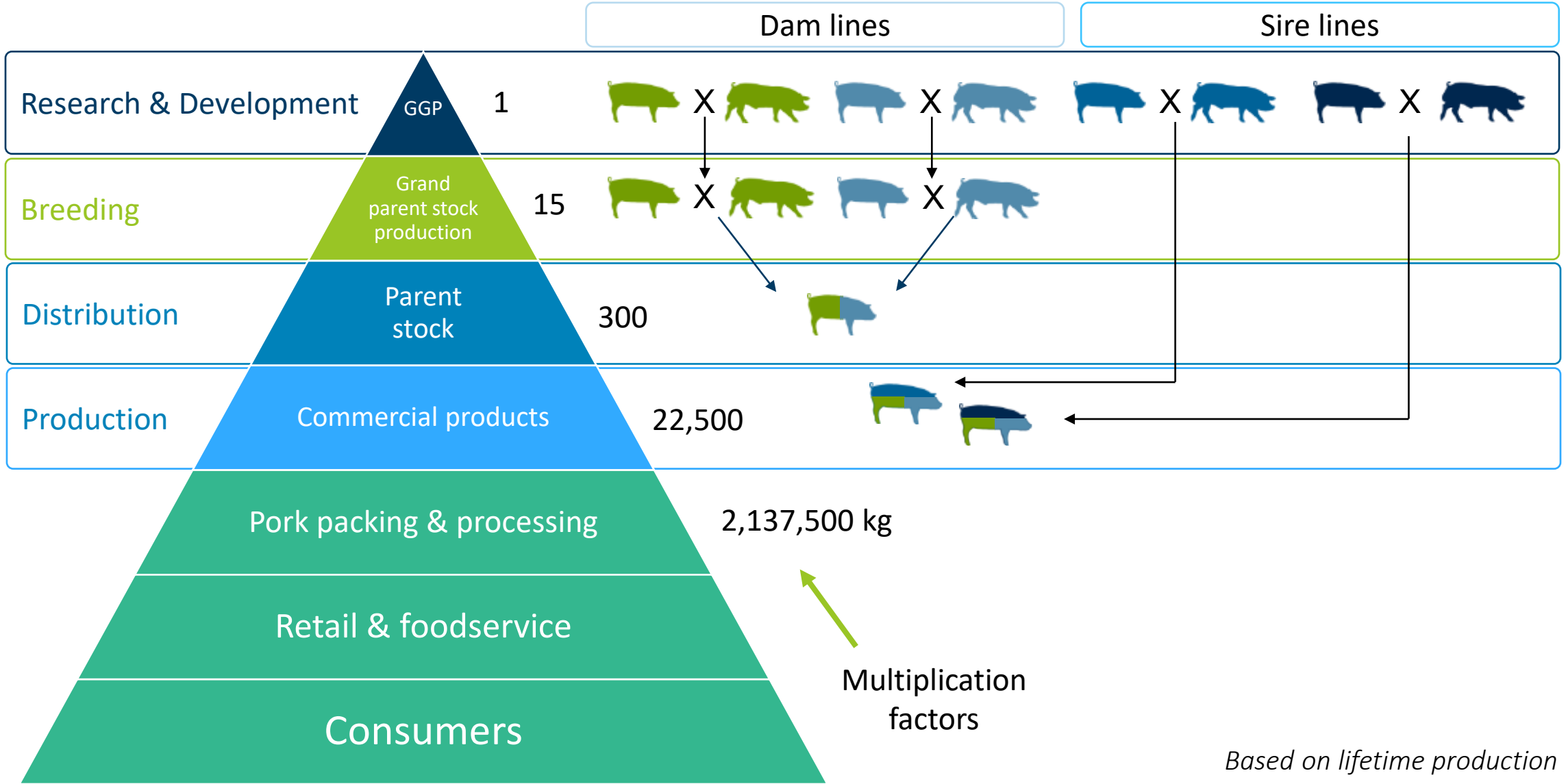
Good for
your eyes

100%
Gluten
free



100% Natural

The pork production supply chain



Based on lifetime production

Counting piglets automatically

Cutting Edge R & D

Farrowing Timelapse

- Automated Sow Farrowing Monitoring System
- Continuous video recording at nucleus facility
- AI-powered computer vision algorithms
- Automatically captures key farrowing data:
  - Total farrowing duration
  - Total number of piglets (live and stillborn)
  - Time intervals between births

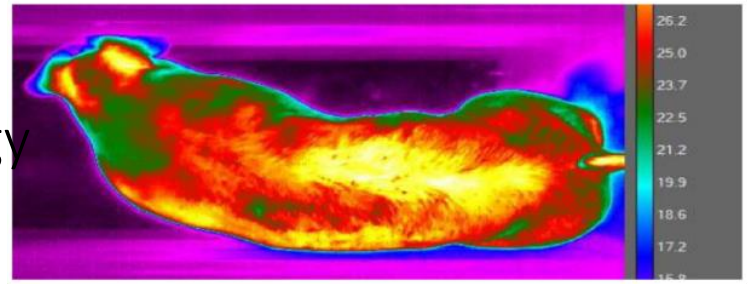
Infrared Thermography

HerdWhistle™

Automated Phenotypic Imaging System

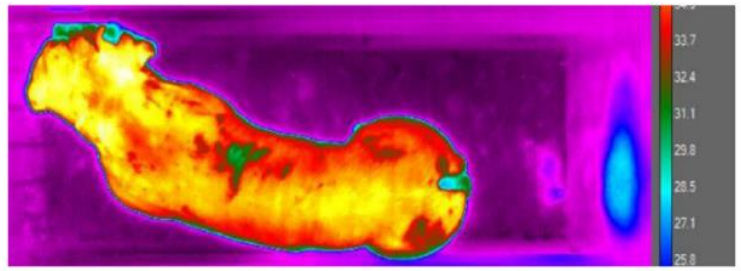
Purpose

- Collect individual pig data using imaging technology



Focus

- Improve feed efficiency
- Monitor health status



Goal

- Help producers boost performance and profitability

Feed accounts for 60-70%
of total pig production costs

Identifying pigs that efficiently convert feed into meat is economically crucial

Introduction

Feed stations used to measured:

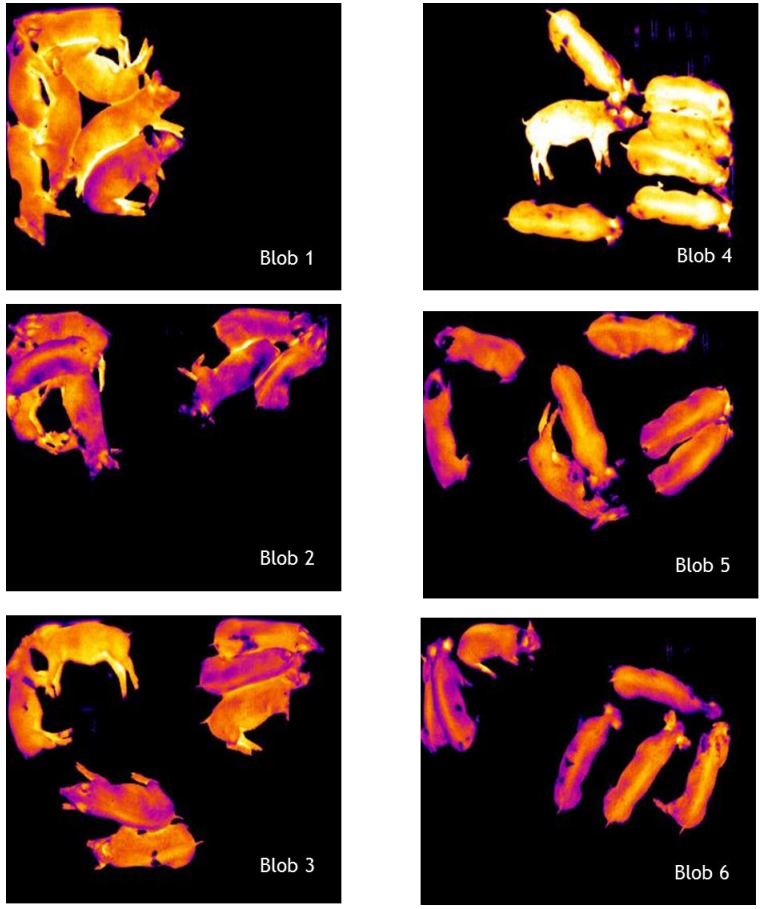
- Feed Intake (FI)
- Feed Conversion Efficiency (FCE)
- Residual Feed Intake (RFI)

Infrared thermography (IRT)

Emerges as a solution for understanding the biological process behind pig growth efficiency

Benefits:

- Non-invasive
- Real-time



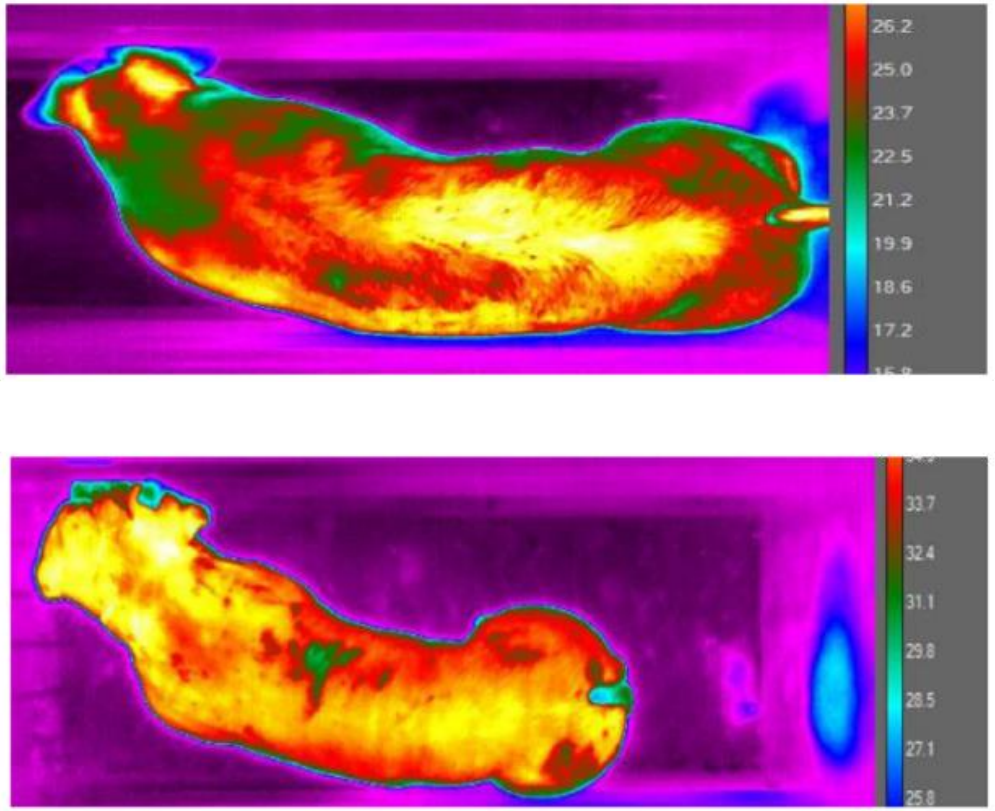
Cook et al. (2020) J. Therm. Biol.
Schaefer et al. (2023) J. Therm. Biol.

Results

Automated thermal camera phenotypic imaging system

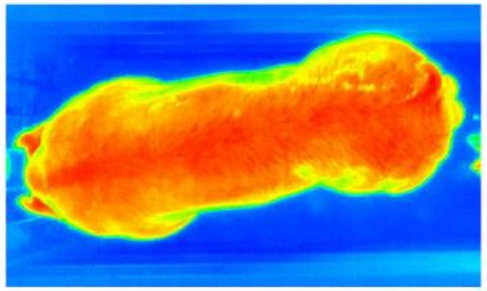
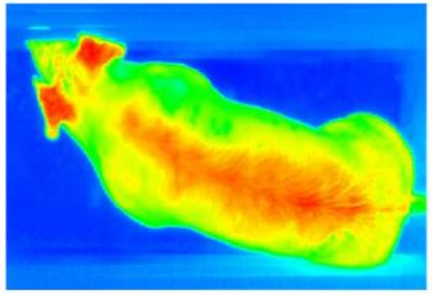
Thermal efficiency index (TEI) estimated for each animal

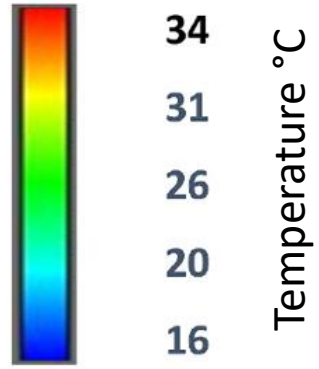
$$\mathrm{TEI} = \frac{\mathrm{Tmean}}{\mathrm{BW}^{0.75}}$$



Schaefer et al. (2023) J. Therm. Biol.

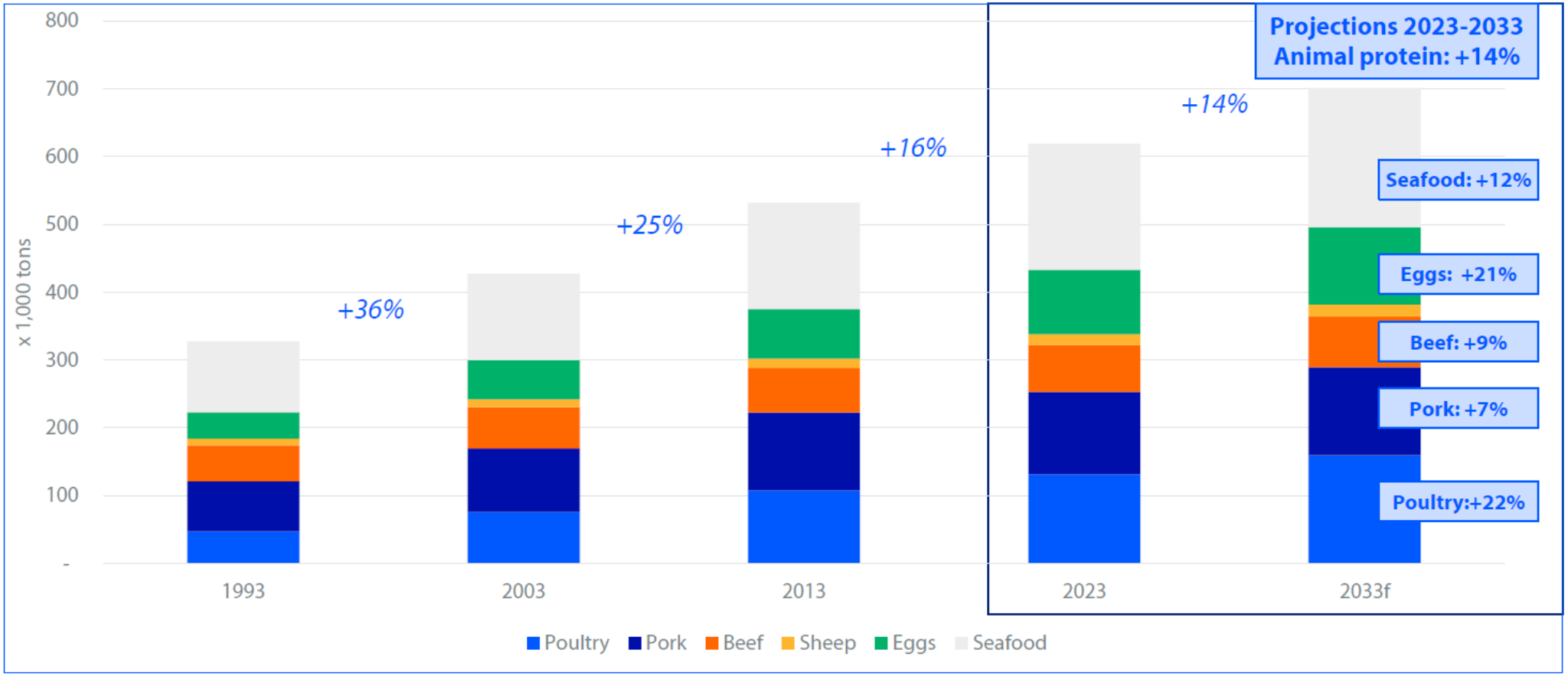
Results

	High TEI	Low TEI
		
Temperature Mean	34.2 °C	31.3 °C
Thermal efficiency index (TEI)	1.13	0.85
Average Daily Gain (ADG)	795 g/d	1,100 g/d
Feed Conversion Efficiency (FCE)	3.2	1.7
Residual Feed Intake (RFI)	551	-771



The future is looking Bright

Global animal protein market outlook 1993 – 2033



Source: *Food and Agriculture Organization of the United Nations, USDA, OECD, local statistics, RaboResearch 2025*

Rabobank

Swine

- Stronger selection for robust piglets with higher survival
- Genetics targeting lower piglet mortality, better vitality at birth, uniform litters
- Emphasis on sow resilience and maternal traits
- Tail-intact production enabled by calmer behavior genetics
- Lifetime efficiency aligned with environmental limits
- Market growth under pressure

Turkeys

- Growing pressure to phase down beak trimming
- Increased focus on genetics for calmer behavior and reduced injurious pecking
- Continued emphasis on leg health and livability
- Breeding for performance under stricter welfare protocols
- Market growth under pressure

Laying hens

- Steady market share increase of white egg layers, driven by efficiency, sustainability and consumer acceptance
- Genetics for long laying cycles with consistent shell quality
- Improved bone strength and mobility in non-cage systems
- Behavioral traits reducing need for interventions
- Wider adoption of in-ovo sexing (the GMO-free approach)
- Steady growth of egg consumption

Broilers

- Clear growth of the slow-growing segment, driven by retailers and welfare labels
- Genetic challenge to close the carbon footprint gap versus conventional broilers
- Focus on maintaining feed efficiency despite longer growing periods
- Robustness and welfare traits embedded in breeding goals
- Steady growth of broiler meat consumption

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Thank you for your attention!

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