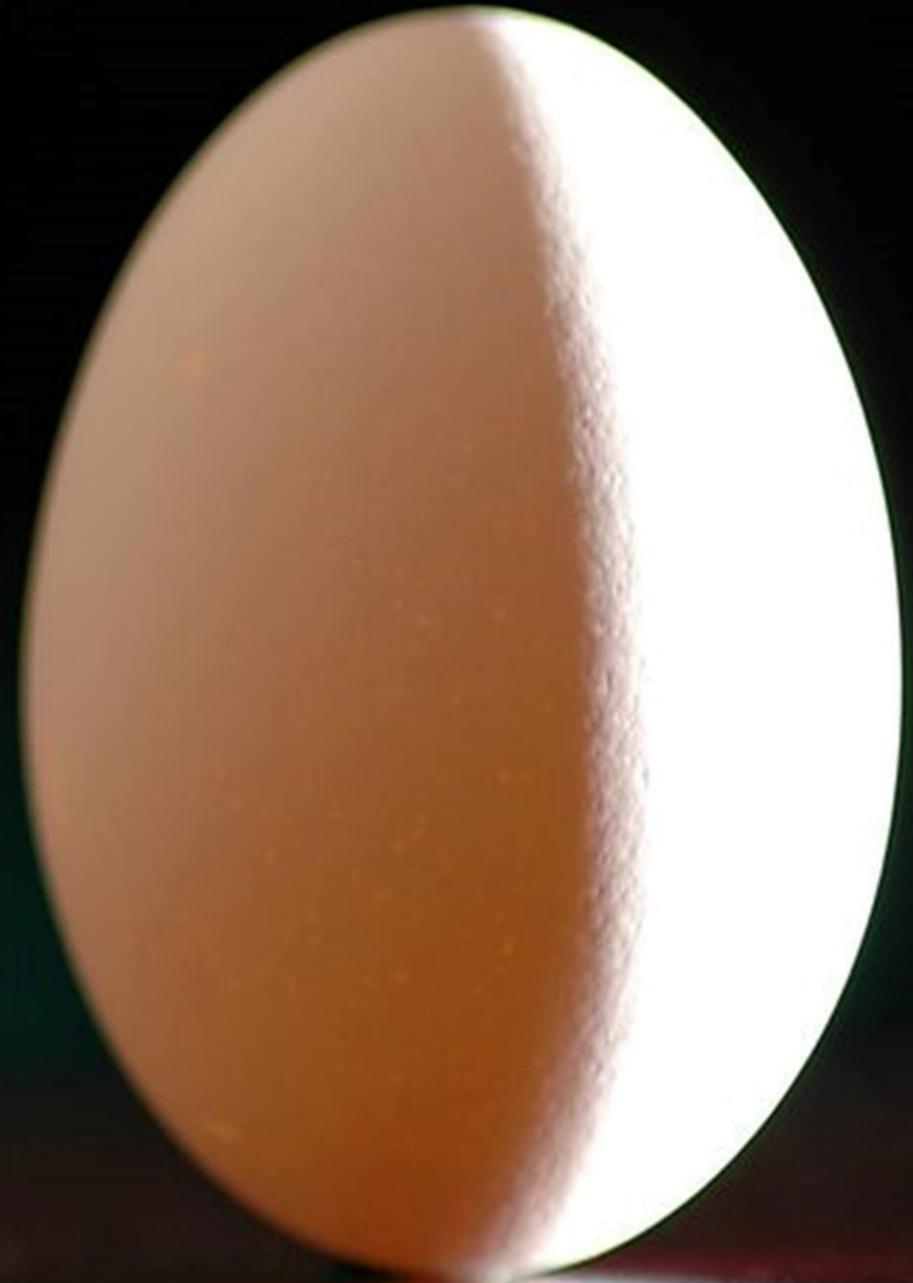


**Application of  
genome engineering  
to facilitate point of  
lay sex-sorting in the  
poultry industry**

**Caitlin Cooper | PhD  
Hendrix Genetics**



Current sex sorting methods in the egg laying poultry industry involve the hatching then culling of approximately 7 billion male chicks



# The pathway to improving the welfare issue and a potential solution

## CURRENT GLOBAL PRACTICE



DAY 21

INCUBATION AND HATCH

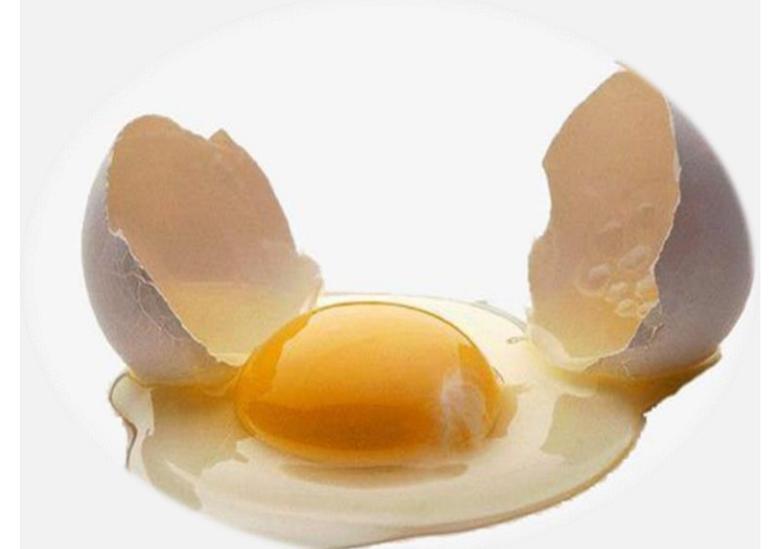
## NEW TECHNOLOGY IN EUROPE



DAY 9 +

INCUBATION AND REMOVAL

## MARKER SORTING – POINT OF LAY



DAY 0

NO INCUBATION : NO GROWTH

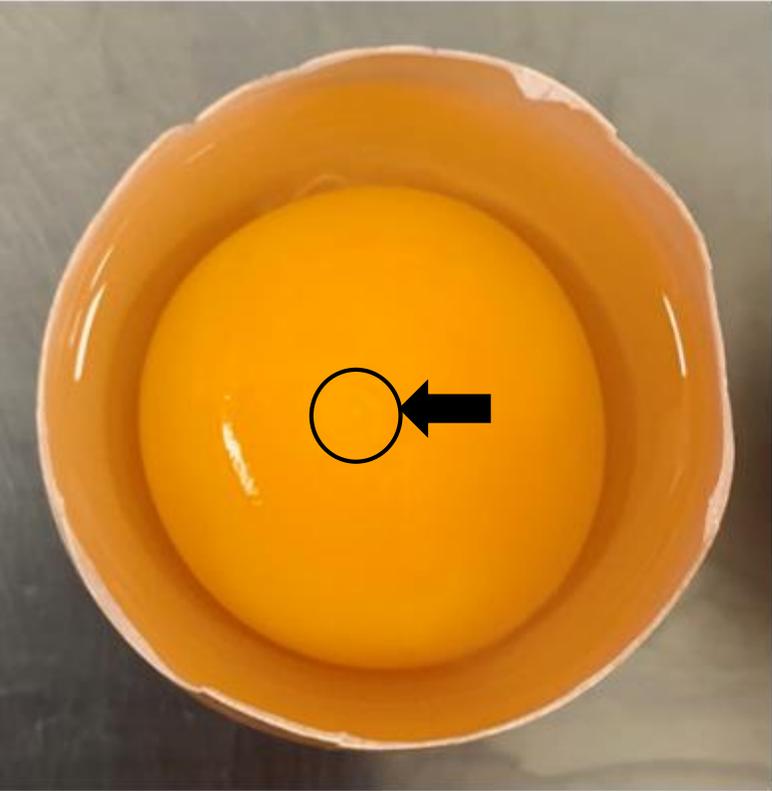
TACKLING THE ISSUE

BIG IMPROVEMENTS ACHIEVED

POTENTIAL COMPLETE SOLUTION

# Point of lay eggs carrying a florescent marker for sorting

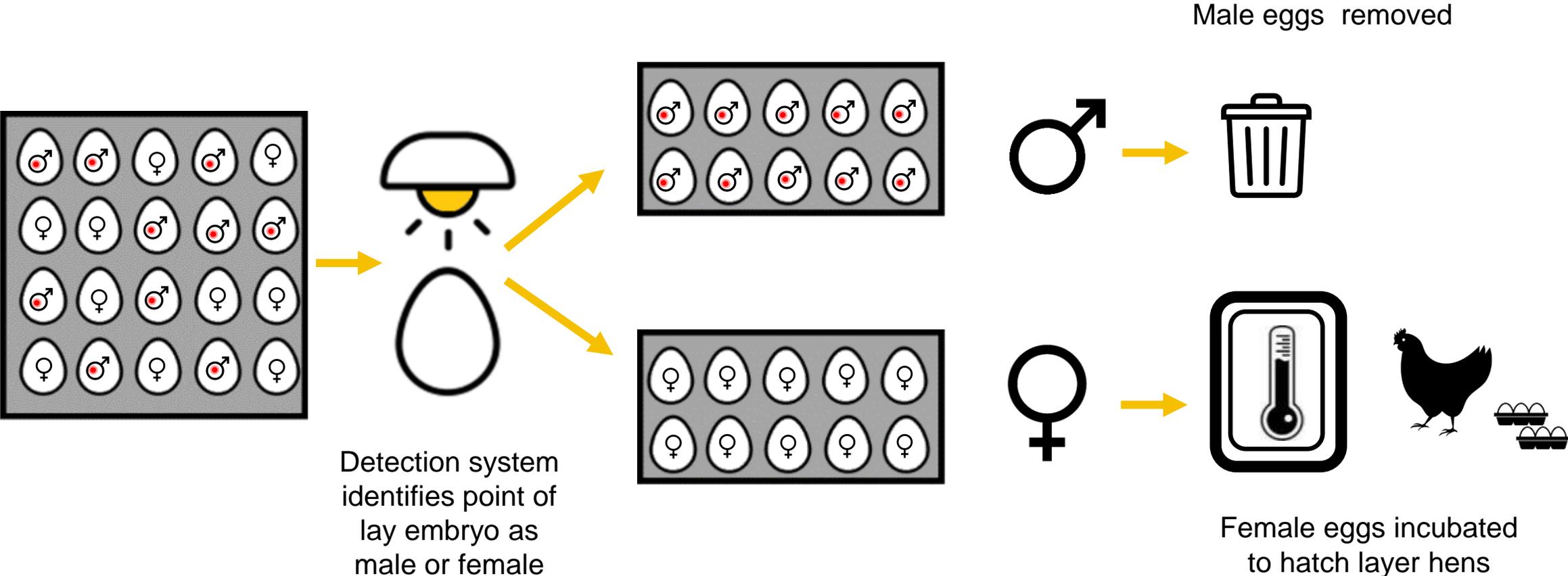
Natural lighting:  
Gene Engineered Blastoderm



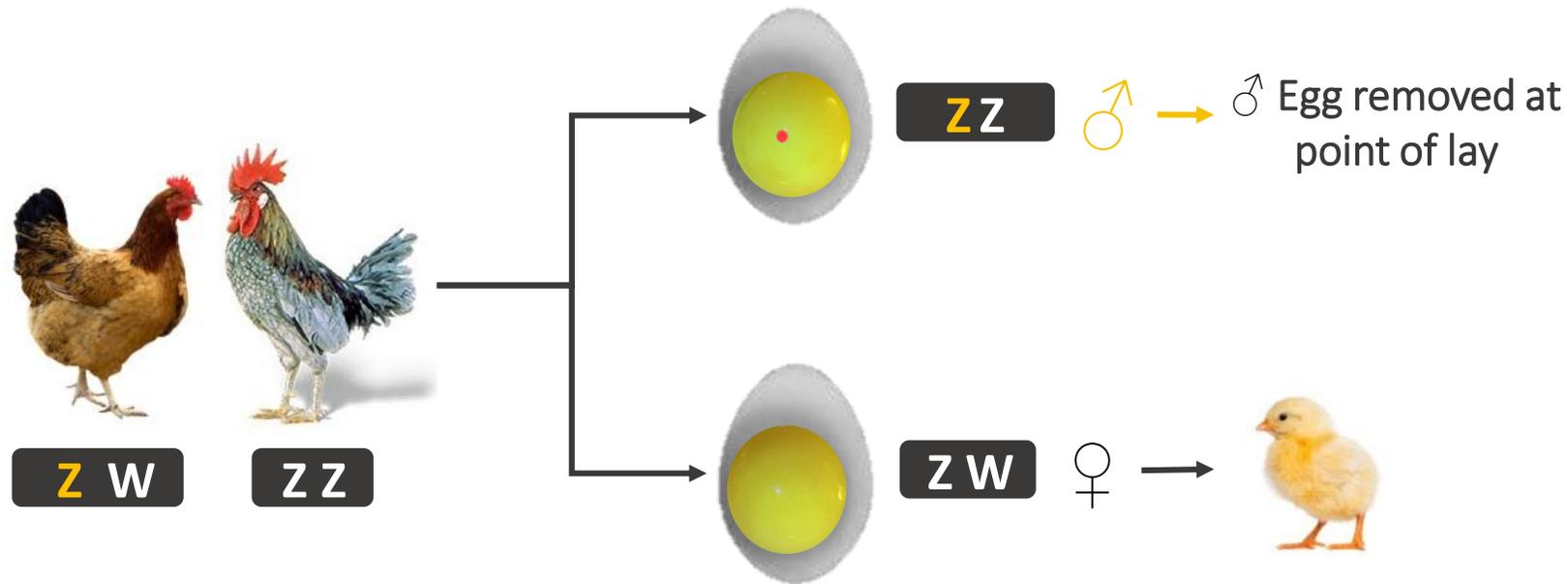
RFP filter:  
Gene Engineered Blastoderm



# Point of lay sorting: Marker detection to separate eggs with male embryos



# Detection at point of lay – achieved by incorporating a detectable marker on the male sex determining chromosome

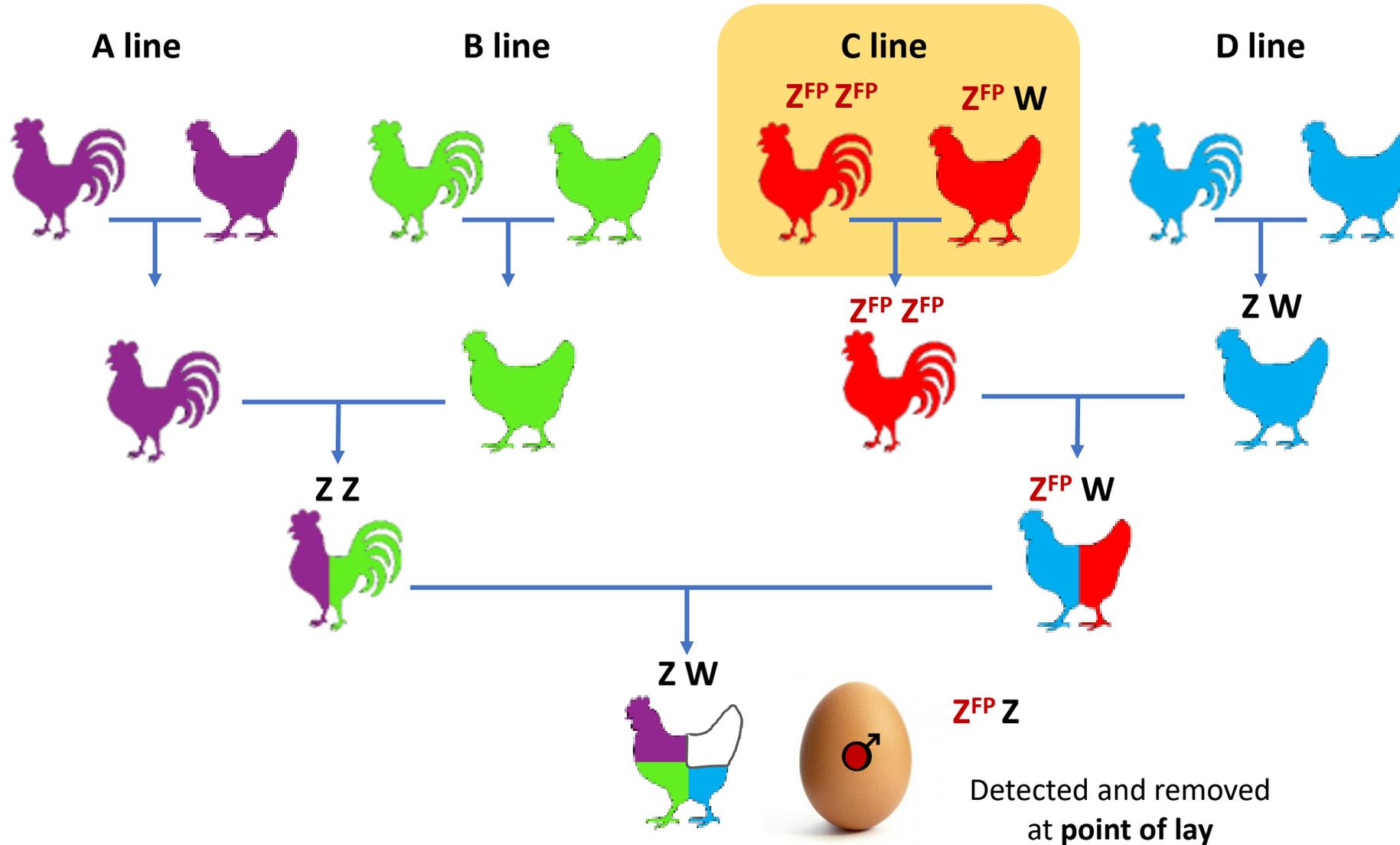


Marker integrated

Detection system identifies point of lay embryo as male

No more culling of day old male chicks

# Integrating marker into the layer industry breeding structure



## Top Pedigrees (Pure Lines)

### Great Grand Parent Lines

Genetic selection and improvement

- Thousands

### Grand Parent Lines

- ~1,000,000

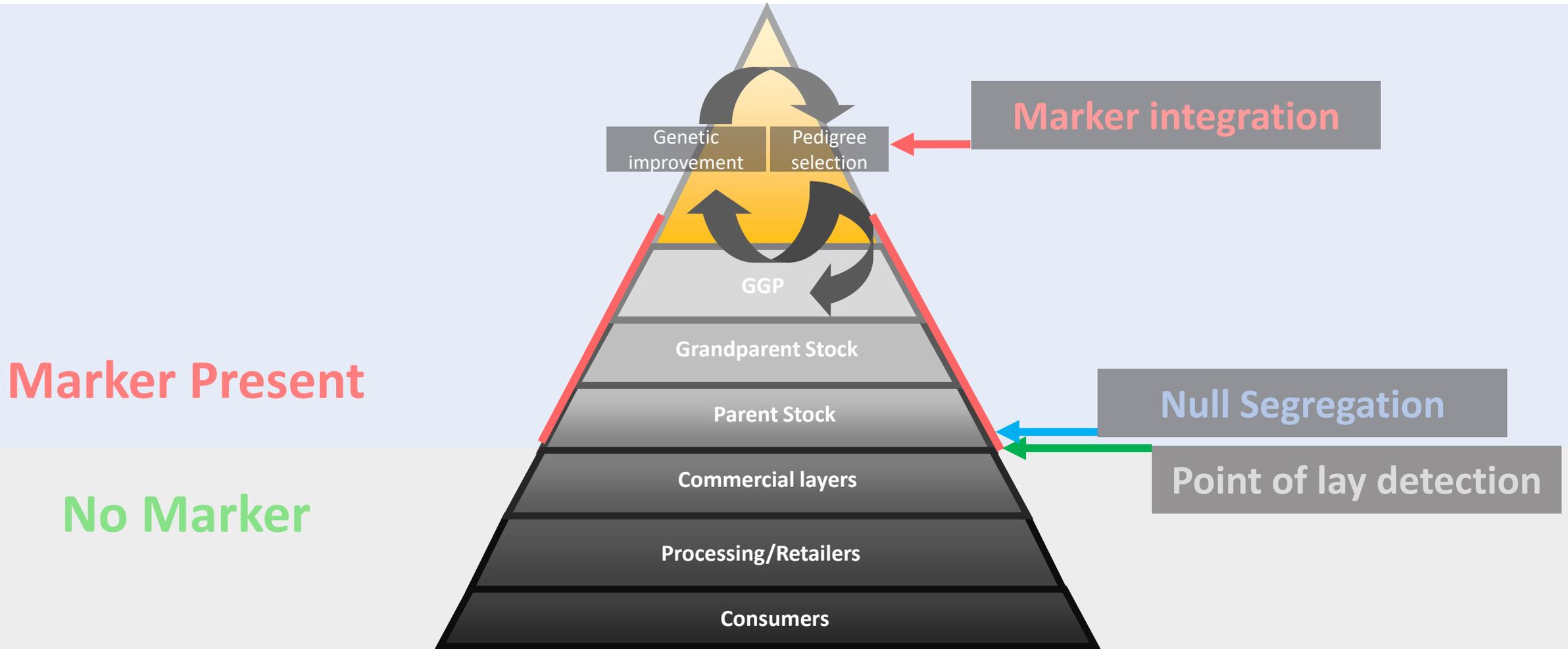
### Parent Lines

- ~50,000,000

### Commercial Layers

- ~6,000,000,000
- ~1,000,000,000,000 eggs

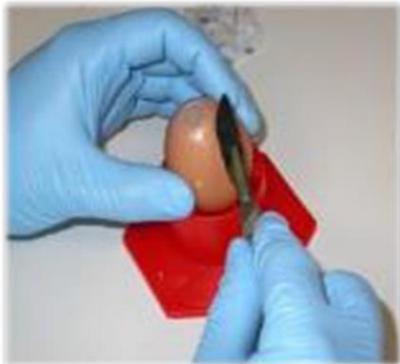
# Integration into the commercial breeding pyramid



# Production of Z-chromosome marked chickens by “direct injection”



**Direct Injection** technique used on embryos *in ovo*  
– to access the **primordial germ cells** –  
to gene edit the Z chromosome and add the marker



Seal eggs and incubate



Hatch G0 chicks; grow to sexual maturity



**Select best G0 males:**  
DNA test for marker in semen

**Breed G0 males:**  
Screen G1 chicks for marker  
in germline

# CSIRO – Genome Engineering Team

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- [Olivier Serralbo](#)
- [Kirsten Morris](#)
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