GEroNIMO and RUMIGEN Joint Final Event

Breeding the Future

Genomics, Epigenomics & Societal

Acceptability for Sustainability in Livestock

Epigenetic dynamics in the chicken brain throughout animal life: From Stress to Resilience

Carlos Guerrero-Bosagna

Uppsala University, Sweden

Funded by the European Union

What did we address?

How early life stress affects animals later in life

Animal welfare issues in chicken production

Overcrowding

Health problems in Broilers

Beak trimming

Transportation of day 1 chicks

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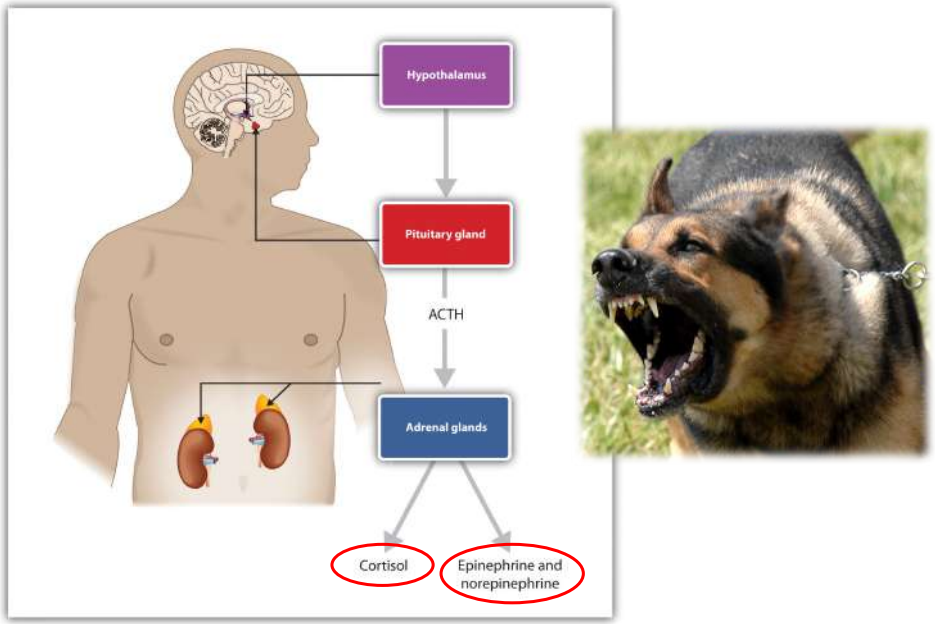
What did we address?

How early life stress affects farm animals later in life

Stress is triggered in many situations in animal production set ups



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What did we address?

How early life stress affects animals later in life

Transportation of day 1 chicks

Later-life Effects

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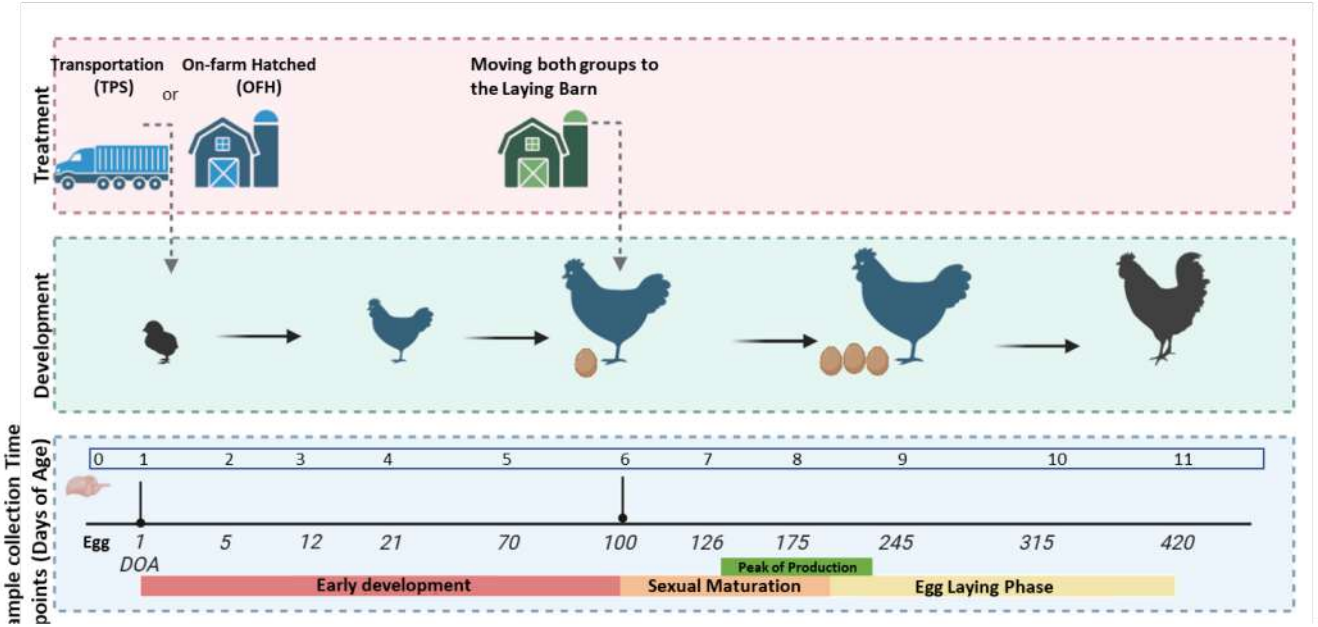
What did we address?

How early life stress affects animals later in life



After Day 1 transportation, we collected blood and brain samples at different timepoints

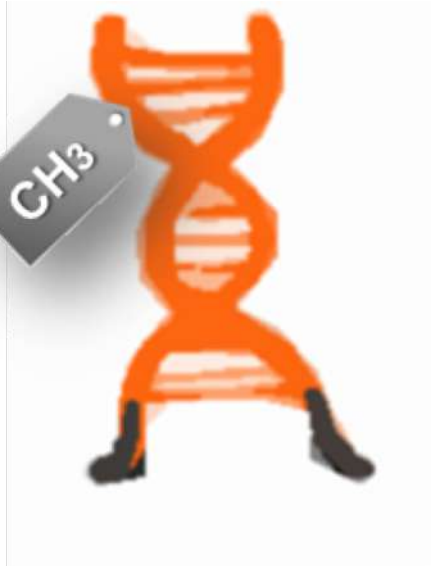
Experiment performed by the group of
Mike Toscano, Bern University

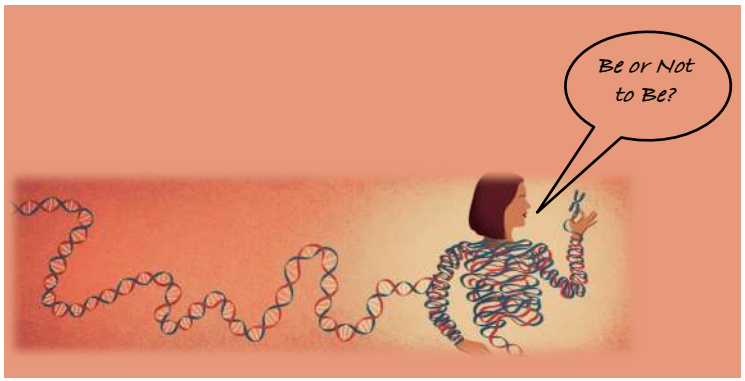
Funded by the European Union

What did we address?

How early life stress affects animals later in life

We measured epigenetic marks: Molecular tags on the genome that regulate the expression of genes





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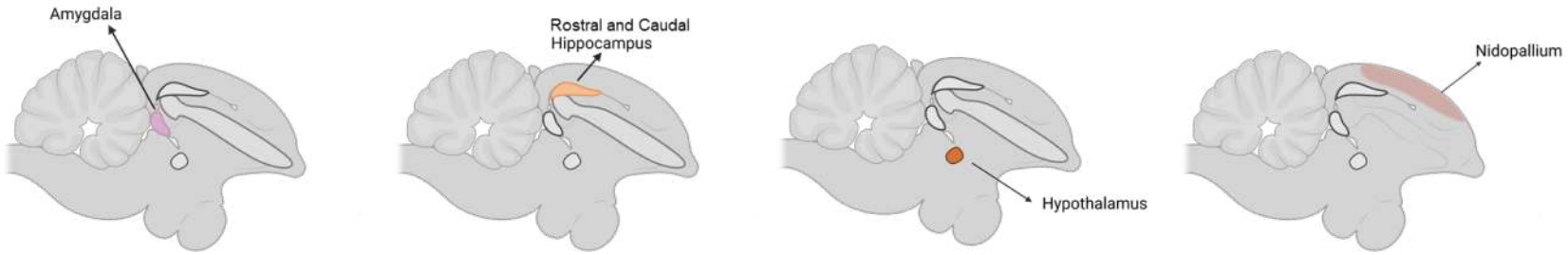
What did we address?

Brain regions investigated



Emotional Regulation

Memory, Stress Processing

Hormonal regulation

Cognitive integration

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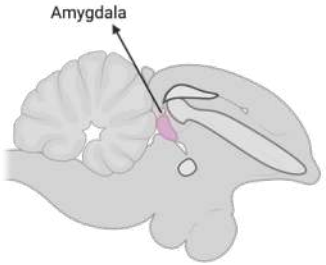
What We Delivered?

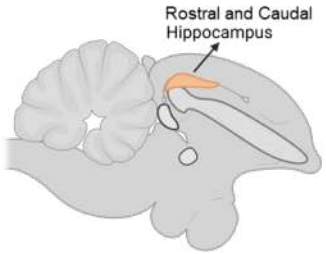
Different brain regions respond differently to stress



Emotional Regulation

⇩

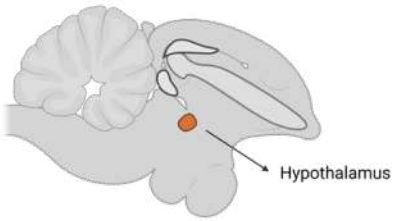
waves of resilience at specific ages



Memory, Stress Processing

⇩

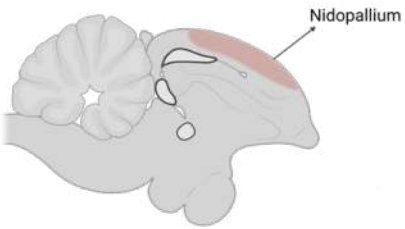
the less stress responsive region



Hormonal regulation

⇩

mainly affected during early life



Cognitive intergration

⇩

affected before sexual maturation

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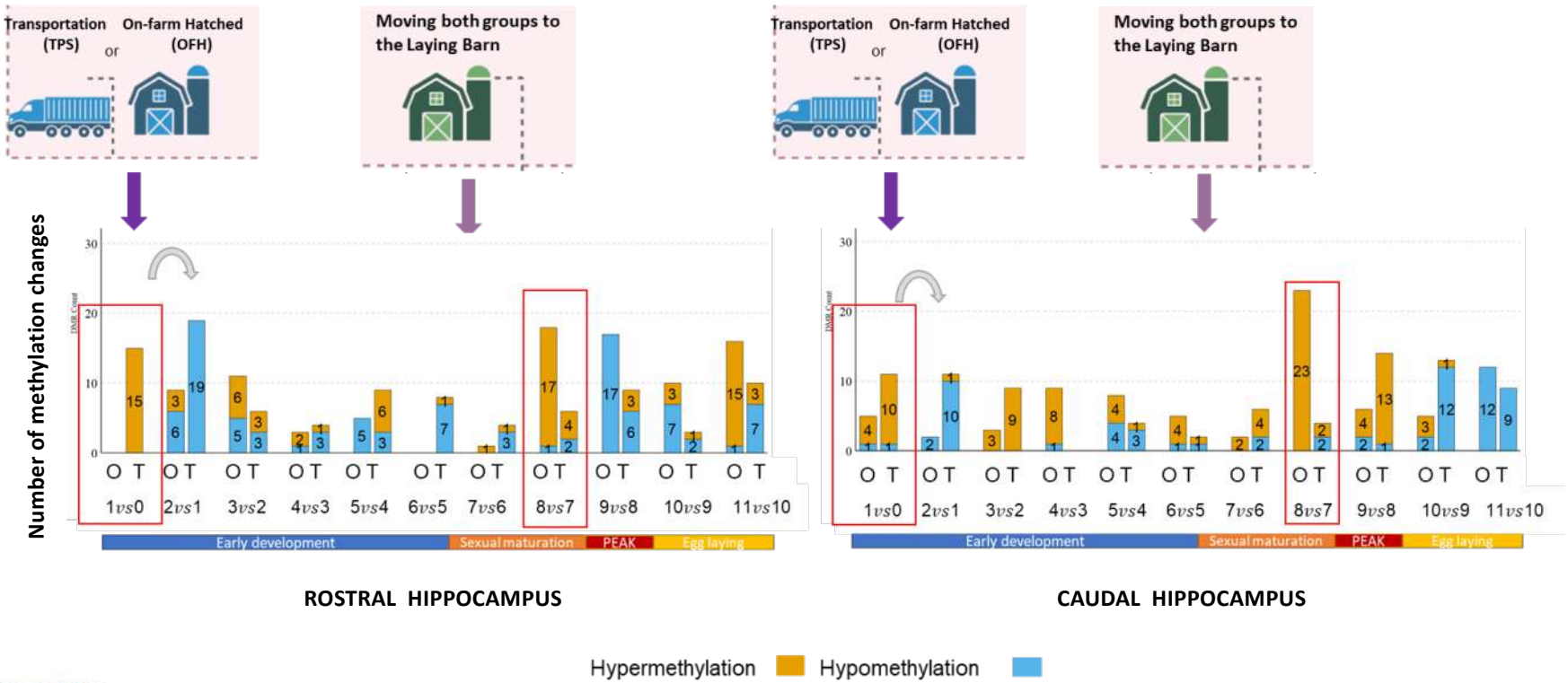
What We Delivered?

Example of data produced



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What We Delivered?

Main scientific findings:

- The effects of early life stress persist across life

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- Early life stress affect different brain regions differently

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- While some brain regions become more resilient to stress, others become affected by stress

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What We Delivered?

Main scientific findings:

- The effects of early life stress persist across life
- Early life stress affect different brain regions differently
- While some brain regions become more resilient to stress, others become affected by stress
- The effects on brain regions are age specific

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What We Delivered?

Paper in preparation:

Brain Specific Methylomic Dynamics Following Early-Life Stress in Chickens

Farnaz Sourani, Ioanna Theoni Vourlaki, Camille M. Montalcini, Matthew B. Petelle, Fábio Pértille, Emmanouil Tsakoumis, Lucy Asher, Yuliaxis Ramayo Caldas, Joëlle Rüegg, Michael J. Toscano, Carlos Guerrero-Bosagna

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Final message:

IMPLICATIONS

- In production settings, we could be able to *predict the neuro-biological effects of specific stressors*

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- This can inform us about whether a *specific early-life stress will negatively or positively affect production traits*

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Final message:

IMPLICATIONS

- In production settings, we could be able to *predict the neuro-biological effects of specific stressors*
- This can inform us about whether a *specific early-life stress will negatively or positively affect production traits*
- For example, *resilience in the hippocampus* could be seen as *positive* in a production setting but it comes together with *effects in other regions* that could be *detrimental*

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Final message:

IMPLICATIONS

- In production settings, we could be able to *predict the neuro-biological effects of specific stressors*
- This can inform us about whether a *specific early-life stress will negatively or positively affect production traits*
- For example, *resilience in the hippocampus* could be seen as *positive* in a production setting but it comes together with *effects in other regions* that could be *detrimental*
- Our results also help us to understand *general biological mechanism of stress response that could also apply to humans*

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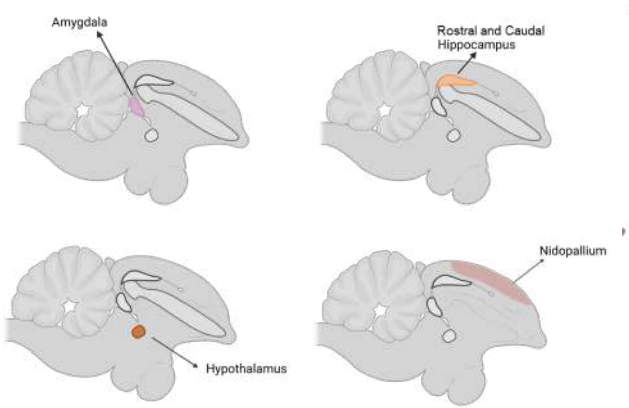
What's Next?

New avenues: more in depth analysis and investigating other layers

➢On different brain regions:



gene expression (transcriptomics) and epigenomics in the whole genome

Understanding of the exact functional consequences of specific early-life stress

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What's Next?

New avenues: more in depth analysis and investigating other layers

➢On production and behaviour traits:

Early life conditions

?

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the European Union

What's Next?

New avenues: more in depth analysis and investigating other layers

➢On commercialization tools:

GERONIMO
GENOME AND EPIGENOME ENABLED BREEDING IN MONOGASTRICS

Neural Networks
Machine Learning
AI

INTEGRATION

FUTUTE GRANT APPLICATIONS

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What's Next?

New avenues for more in depth analysis and investigating other layers:

- On different brain regions: gene expression (transcriptomics) and methylation in the whole genome can be investigated to understand the exact functional consequences of specific early-life stress.
- On production and behaviour traits: early-life conditions can be identified that could potentially conciliate animal welfare and production traits.
- On commercialization tools: Future grants for comprehensive intergtration of our data and that of other Geronimo groups for potential commercial applications

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Genomics, Epigenomics & Societal

Acceptability for Sustainability in Livestock

THANK YOU

TOWARDS IMPROVEMENT OF RUMINANT BREEDING THROUGH GENOMIC AND EPIGENOMIC APPROACHES

GENOME AND EPIGENOME ENABLED BREEDING IN MONOGASTRICS

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