

SHORT TERM SCIENTIFIC MISSION (STSM) SCIENTIFIC REPORT

This report is submitted for approval by the STSM applicant to the STSM coordinator

Action number: CA15224 - Identifying causes and solutions of keel bone damage in laying hens

STSM title: Epigenetic marks to assess welfare and behavior in laying hens

STSM start and end date: 2019-09-23 - 2019-09-28

Grantee name: Carlos Guerrero-Bosagna

PURPOSE OF THE STSM:

The purpose of this STSM was to investigate ways to incorporate epigenetic marks into improved animal welfare practices. We are a group of researchers from different research areas joining forces towards the main aim of correlating behavioral patterns to epigenetic marks in the brain and peripheral cells. We hope that the use of epigenetic tools will help to identify positive and detrimental conditions in the production environment, and consequently improve the welfare of laying hens, which includes prevention of keel bone damage. The expectation is that by looking at epigenetic marks we will be able to identify if animals have been exposed to detrimental conditions (e.g., stress, exposure to chemicals) in the production environment. When using peripheral cells from live animals, this strategy will allow for rapid evaluation of previous exposures or health/welfare status.

The overall aim is providing grounds for understanding the causes behind individual behavioral variation in farm animals, specifically in relation to their preferences or needs within the production environment. This will ultimately improve their welfare by advancing towards 'precision livestock farming' practices.

DESCRIPTION OF WORK CARRIED OUT DURING THE STSMS

The one-week meeting held in Switzerland and hosted by Dr Michael Toscano from Bern University was extremely productive.

In the first days we spent hours discussing ways to integrate our different areas of expertise into the topic of animal welfare and phenotypic variation in the realm of animal production. Then, we moved to concrete actions using our joint capabilities.

The first days of the meeting consisted in presenting our own expertise to the other participants in order to find points of convergence and common understanding. Once these points of convergence were defined, we joined efforts to interpret existing data and propose new experiments and

approaches. Our efforts also converged to draft a manuscript based on results from previous joint research endeavours.

DESCRIPTION OF THE MAIN RESULTS OBTAINED

The results of the STSM include the drafting of a manuscript to be soon submitted on the topic of epigenetic basis of behavioral individuality. We analyzed data emerging from a relatively large and uniform population of laying hens to identify the relationship between behavioral patterns (detected with novel metrics) and epigenetic variation in a brain region involved in the processing of higher cognitive abilities (nidopallium). We found results supporting the position that the natural emergence of behavioural variation in chickens is mainly related to epigenetic variation within brain tissues. We identified linkages between chickens belonging to different behavioural classification schemes and differential DNA methylation in the nidopallium. Interestingly, these were mainly located in regulatory genomic regions, that were, moreover, functionally concordant with their specialized abilities.

FUTURE COLLABORATIONS (if applicable)

In relation to future collaboration we defined a very concrete plan with well-defined common goals. In terms of research, these include the investigation of the epigenetic basis of behavioral individuality at a developmental level, as well as the early identification of detrimental conditions in the production environment, such as keel bone damage, through epigenetic mechanisms. In terms of planning, we scheduled a future meeting to be held in Sweden, where we will check the status of the progresses and officially launch a new research project. We also agreed to identify funding sources where we could apply together as a group.