SHORT TERM SCIENTIFIC MISSION (STSM) – SCIENTIFIC REPORT

The STSM applicant submits this report for approval to the STSM coordinator

Action number: CA15224
STSM title: Training to detect keel bone damage in laying hens
STSM start and end date: 05/08/2018 to 10/08/2018
Grantee name: Elena Armstrong

PURPOSE OF THE STSM

The purpose of the completed STSM was that I may be trained by experts at the host institution to reliably detect keel bone breaks in laying hens using palpation. I require this skill in order to sample birds with relation to fracture severity during my PhD research project (and potentially thereafter). My PhD studentship is funded by the Universities Federation for Animal Welfare (UFAW) and focuses upon validating a long-term marker of welfare state in the poultry brain. Given the prevalence of keel bone damage in commercial laying hen systems, the influence of acquired keel bone fractures on adult hippocampal neurogenesis (AHN), a candidate marker of chronic stress across species, is of great interest. Results of our initial work suggest that avian AHN is indeed suppressed by severe keel bone damage, as it is by chronic pain in rodents, and moreover that there is a correlation between scored fracture severity and hippocampal cell counts for individual birds. Such evidence links keel bone damage to the experience of chronic stress for the birds, which is likely associated with a negative affective state, and may support the development of solutions to the acquisition of damage, as well as potentially facilitating evaluation of their efficacy in terms of the subjective experience of hens. Our use of palpation as a technique during on-farm sampling is crucial give that financial constraints/lack of equipment make radiography impractical in this instance, whilst we must select appropriate birds from the farm for transport and dissection elsewhere, meaning collection of the keel from the carcass for post-hoc verification might not leave us with the desired sample. As such, it was important for me to learn the reliable and standardised technique for keel bone palpation pioneered by members of the host institution.

DESCRIPTION OF WORK CARRIED OUT DURING THE STSMS

Whilst visiting the Aviforum (Centre for Proper Housing: Poultry & Rabbits, University of Bern), I attended data collection sessions for a study run by Dr Ari Stratmann to investigate the welfare impact of providing laying hens in a multi-tier housing system with ramps to access the levels. As one of the outcome variables of interest was keel bone damage, radiographs were being collected from focal birds, which provided an opportunity to verify the assessments of fracture presence and severity I made through palpation. Additionally, the birds were 65 weeks of age, which is similar to those I will be sampling in collaboration with a commercial UK egg production farm in October. Instructed by Dr Michael Toscano, we selected hens to palpate prior to collection of their radiographs. After guidance and practice at catching and handling birds, I was taught to palpate the keel bone with the hen held upside down by its legs and its back

placed against my chest. In order to standardise the learning process, I recorded my assessments by drawing the keel of each bird and dividing this into top, middle and bottom sections. Where I felt a fracture, callous or deviation, its location was recorded on the diagram. This process was repeated for multiple birds. At intervals, I viewed the corresponding radiographs to identify visible fractures with the guidance of a vet. Using this method, fracture lines, breaks and deviations could be quantified, whilst callouses formed around fractures appear white due to their high mineral densities. It was thus possible to confirm the assessments I made through palpation for individual birds, which allowed me to improve their accuracy with practice and relate what I felt to the various forms of damage visible via x-ray. As the final stage of my comprehensive training in the identification of breaks, I was taught to dissect the keel bone from the carcass for visual inspection and verification of conclusions drawn via palpation and radiograph. Again, this was conducted for the same birds I sampled, so that my diagrams of the damage I had detected in live birds using my hands could be matched to the detached bones. After observing Dr Toscano conduct the dissection, I was supervised in extracting the keel myself and after multiple repetitions, learnt to do this cleanly and safely. This gave me the opportunity to view the fractures by eye, whereby they appear as lumps or raised lines and grooves which run horizontally across the inner surface of the bone.

During the STSM I additionally had the opportunity to gain experiences in Swiss poultry production, through attending guided tours of facilities with major supplier FarmTek. This included systems for incubating eggs/laying hen pullet hatcheries to those for the sorting, treatment and distribution of eggs produced for sale to the public.

DESCRIPTION OF THE MAIN RESULTS OBTAINED

Following the training I received during the STSM, I have acquired a standardised method for assessing categorical fracture severity in laying hens (*i)* minimal, vs *ii)* moderate vs *iii)* severe damage). This involves holding the bird upside by both legs, with its back pressed to my chest, and first locating the keel bone via its top and bottom ends with a finger and thumb. Palpation is then conducted by running the tip of the index finger & thumb along the length of the surface of the bone whilst pressing them together. It is helpful to push any lumps or deviations encountered, as fat and muscle will move whereas bone remains rigid. I learnt that damage is most commonly acquired in the bottom third of the keel bone (nearest the feet), and is particularly prevalent just before the tip. Fractures can usually be felt through the large, swollen callouses which form around them at one or both sides of the bottom of the bone, and characterise instances of severe damage. Lumps or dips along the length of the bone are also likely to represent fractures. Bends in the keel bone may not be fractures when they are smooth, but likely to be if a sharp angle of deviation can be felt. In addition I learn to identify fractures, deviations and callouses from radiograph images of the keel. Moreover, I am now able to dissect the keel bones from the carcasses myself and will in future be able to collect these to freeze for verification of damage assessments made during sampling. If necessary, this will allow me to control for the presence of any fractures missed at the palpation stage during statistical analysis of the resultant data.

As a result of the STSM, I feel confident in my ability to palpate birds and detect damage during our sampling of commercial laying hens in collaboration with UK industrial partners, first planned for October 2018. During the STSM, I was also reminded of the prevalence of bumblefoot as a specific welfare issue in laying hens, and observed some severe cases of the condition. I thus now plan to factor its presence into my sampling of commercial birds in good versus poor physical condition within housing systems, as we wish to compare the variation observed between systems to that present within them for birds with varying experiences.

Finally, my experiences of Swiss poultry production exposed me to procedures conducted either side of housing adult laying hens (i.e. pullet hatching and egg treatment/distribution) and associated considerations, which broadened my understanding of both the early life experience of the birds and the

multitude of commercial systems involved in egg production. In particular, this increased my appreciation of financial, ethical and legislative influences on production practices, as well as challenges involved in collaboration with industry to effect changes designed to improve welfare.

FUTURE COLLABORATIONS (if applicable)

(max.500 words)

Continuing collaborative work is planned between my research group (led by Dr Tom Smulders, Newcastle University) and members of the host institution (ZTHZ), with the goal of relating existing measures of poultry health to adult hippocampal neurogenesis. This partnership will allow for assessment of the impact of many factors which influence laying hen welfare on our neural marker of long term affective state.