SHORT TERM SCIENTIFIC MISSION (STSM)
SCIENTIFIC REPORT

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

Action number: CA15224
STSM title: Keel bone damage palpation training and brain dissection demonstration
STSM start and end date: 05/01/2020 to 09/01/2020
Grantee name: Matthew Craven

PURPOSE OF THE STSM:

I have recently started a PhD project at Newcastle University, in which I am using adult hippocampal neurogenesis (AHN) to measure the effects of different housing environments on chronic stress in laying hens. This project is under the supervision of Dr Tom Smulders, whose research group has found that in a range of species, fewer neurons are generated in hippocampus of animals experiencing chronic negative welfare states (Gualtieri et al, 2017; Robertson et al, 2017). Our group has also recently found that hens suffering from keel bone damage (KBD) have reduced AHN compared to controls (Armstrong et al, submitted). KBD is a very common health condition in laying hens and it is known that housing design can be a contributing factor to KBD, with increased complexity of the housing environment leading to a higher prevalence of fractures (Sandilands et al, 2009).

The main aim of this STSM was to learn how to palpate for KBD, in order to use this skill in experiments which will build on my group's previous work. I also aimed to share my knowledge of dissecting the brain in order to train other students to use this method in future experiments which will explore the relationship between housing, KBD, and chronic stress. In order to achieve these aims, I travelled to the University of Bern to work with Dr. Michael Toscano's research group at the Centre for Proper Housing: Poultry and Rabbits (ZTHZ).

DESCRIPTION OF WORK CARRIED OUT DURING THE STSMS

Firstly, I assisted with an x-ray session and observed other health assessments as part of an ongoing experient at the Aviforum. In this experiment, the movement of hens (n=108) within a multi-tier aviary was recorded using tracking devices. In each of 6 pens, 18 focal individuals were wearing backpacks which contained the devices. All focal individuals from a pen were caught and weighed. These then underwent a variety of health assessments (such as footpad dermatitis scoring), and a photograph was taken of each individual's comb. After the health assessments, the hens were taken to the x-ray team. I assisted the x-ray team by removing tracking devices from backpacks and hanging each bird into a frame by her legs. When the hen was in place, an x-ray image of the keel bone was taken. I looked at many of these images to learn how to identify the fractures. I then put the trackers back into the backpacks, and the birds were taken back to their pens.

The next day, I returned to the aviary to practise palpation for KBD. Dr Toscano taught me how to assess KBD using the simplified keel assessment protocol (SKAP) (Casey-Trott et al, 2015). I caught a bird, restrained it by the legs, held it securely against my chest, then ran thumb and forefinger along the length of the keel bone. I was taught how to identify old fractures (identified by calluses), new fractures (identified by swelling), and deviations. I used a tactile scale consisting of 3 models to standardize the assessments, and also used these to award each keel bone a severity score between 0 and 10. I repeated this several times until I was comfortable with the assessment protocol.

Later, we entered another aviary in which the birds were older and had more severe KBD. We selected three individuals who were in poor condition, and I palpated the keels of these birds. I recorded the fractures that I had observed on diagrams such as Figure 1 below. In this example, the marking on the diagram shows that I have diagnosed a large fracture at the tip of the keel bone.

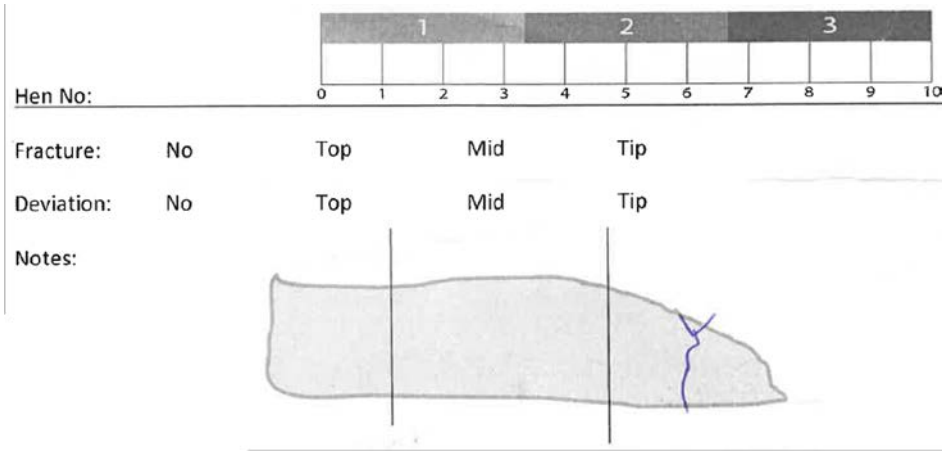

Figure 1 – Example of diagrams used to visualize diagnosed KBD

Again, I used the tactile scale to give each keel bone a score between 0 and 10. After I had palpated the keel bones, the three selected individuals were euthanised. I demonstrated how to remove and dissect the brains of two of these chickens for the quantification of neurogenesis. This is a skill that will be useful for three PhD students at the University of Bern, who observed the dissections. After my demonstration, one of the students (Vivian Witjes) then practised dissecting the third brain under my instructions. Dr Toscano then demonstrated how to dissect out the keel bones of the three birds, and we compared the actual damage to the diagrams that I drew while palpating earlier. This was also an excellent opportunity for networking, and equipped me with skills and ideas for future experiments in which palpation for KBD will be necessary.

DESCRIPTION OF THE MAIN RESULTS OBTAINED

In all three birds that were selected from the second barn, fractures were diagnosed by palpation and were recorded as in the diagram above. These fractures were confirmed when the keel bones were dissected out, although there were found to be some additional fractures which I did not identify during palpation. This highlights the importance of practice in order to accurately detect fractures.

Since completing this STSM, I have used plans supplied by Dr Toscano to 3D-print a set of model keel bones similar to those used during my training. I recently used these models when selecting hens for the next phase of my PhD project. I palpated the keels of hens taken from a flat deck system and from a multi-tier system, and scored them according to the tactile scale. These birds were only 24 weeks of age, and as expected, the prevalence of KBD was relatively low in both systems. I selected 12 hens from each system which were appropriate for my experiment. From each bird I collected brain, gut, and spleen samples which are currently being analysed at Newcastle University. These will be used to compare the chronic stress experienced by hens living in each of the two housing systems. When these two flocks reach end of lay (around 74 weeks of age), I will collect samples from more birds. At this age, it is likely that there will be more severe KBD. Again, I will score birds from each system for KBD and will collect brain, gut, and spleen samples to quanitify chronic stress. The training that I received during this STSM will be invaluable when assessing KBD in these older birds.

FUTURE COLLABORATIONS (if applicable)

It is hoped that the networks built during this STSM will be useful in future collaborations between Newcastle University and ZTHZ. There will be ongoing discussion about the interactions between housing environments, KBD, and the brain.