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**Research related to Avian Reproduction and its consequences using Genetics and  
Physiology.**

Neuroendocrinology,  
Control of growth; broiler breeder paradox.  
Egg defence mechanisms; shell, cuticle, antimicrobial proteins.  
Bone quality in laying hens.

## **Era-Net ANIHWA Better Bones project**

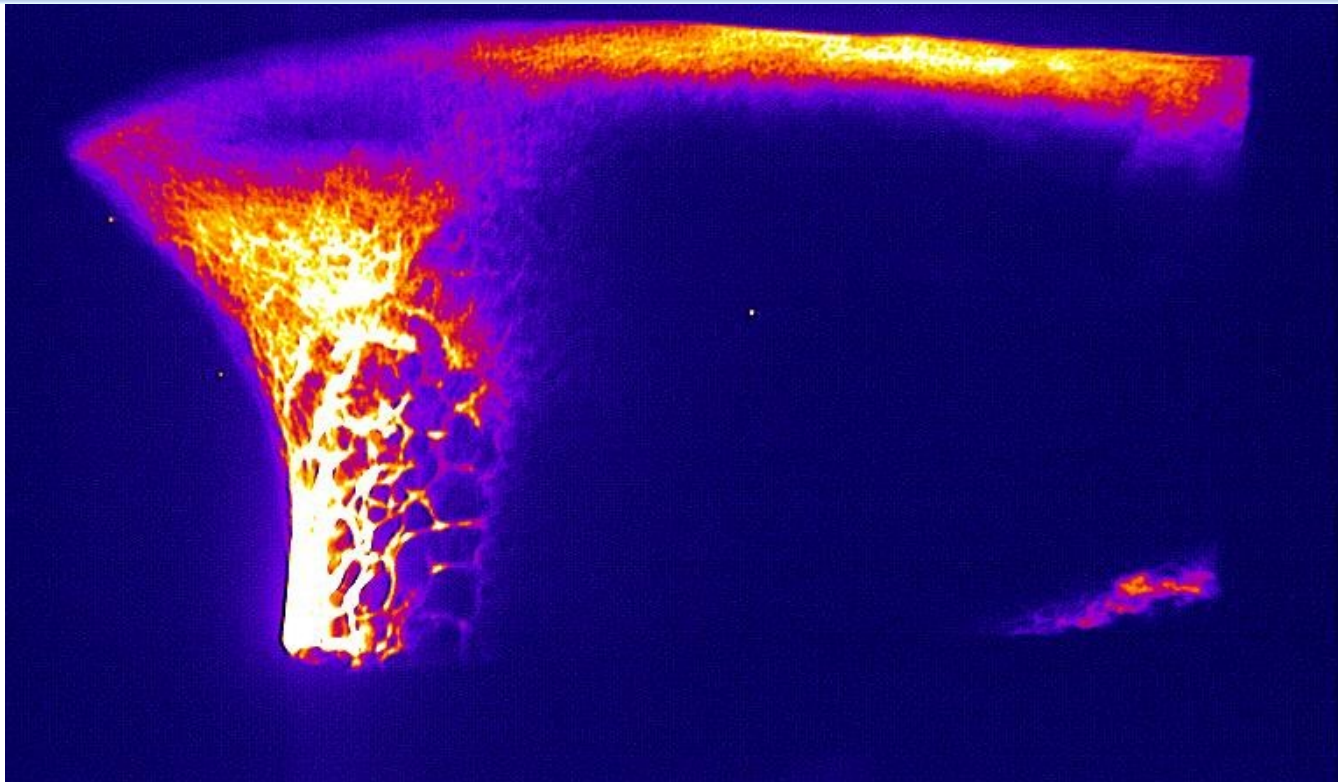
Looking at genome wide association analysis, novel phenotypes, biochemical markers and physico-chemical techniques and their potential to deliver genetic improvement.

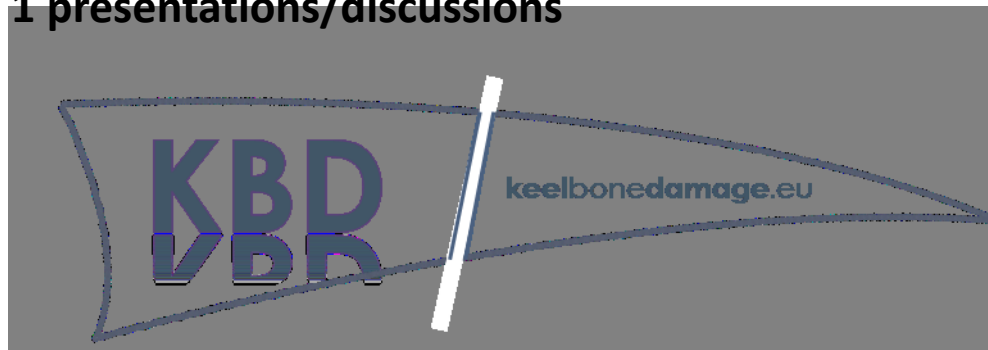
**University of Edinburgh, Swedish University of Agricultural Sciences, Lohmann  
Tierzucht, SRUC, University of Granada**

**Ariane Stratmann, Veterinary Public Health Institute, Animal Welfare Division, University of Berne, Switzerland.**



**Ariane will take over leadership in the 2<sup>nd</sup> half of the action.**



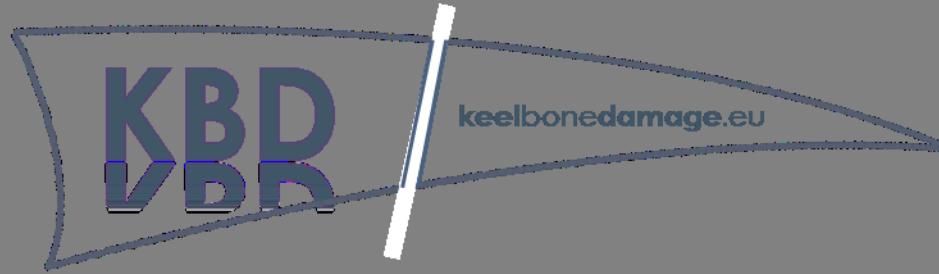


**It is impossible to improve something if you cannot measure it.**

## **Aim**

**WG1 will serve to coordinate efforts in developing a battery of techniques capable of identifying keel bone damage with a level of accuracy, sensitivity, and detail that meets the needs of the study environment and purpose.**

**Researchers will share their ongoing efforts in developing methods that can be performed on-farm (e.g., palpation, portable radiography ) as well as more technologically advanced means suited for laboratories that can provide greater qualitative detail (e.g, computed tomography, histology).**



**There appears to be different requirements for different purposes but the ultimate objectives are the same.**

- To assess incidence of KBD to support efforts to improve nutrition and housing to reduce KBD. This could be in live animals or at *post-mortem*.**
- To quantify damage or correlates of damage to improve the genetics of the hens. This would ideally be performed in the living hen, quickly and cheaply.**



# Keel bone radiographic density is genetically correlated with other bone quality traits

**Table 3.** Heritabilities (with standard errors), phenotypic correlations and genetic correlations (with standard errors) for body weight and bone traits (n=1306)\*

	Body weight	Keel RD	Humeral strength	Tibial strength	Bone Index
Body weight	<b>0.49</b> (0.06)	0.28	0.21	0.29	-0.10
Keel radiographic density	0.36 (0.06)	<b>0.39</b> (0.06)	0.33	0.51	0.58
Humeral strength	0.26 (0.11)	0.49 (0.11)	<b>0.30</b> (0.06)	0.50	0.66
Tibial strength	0.33 (0.10)	0.66 (0.08)	0.77 (0.07)	<b>0.45</b> (0.06)	0.81
Bone index	-0.12 (0.12)	0.67 (0.08)	0.76 (0.07)	0.84 (0.04)	<b>0.40</b> (0.06)

\* Heritabilities on diagonal (bold), phenotypic correlations above diagonal, genetic correlations below diagonal.

BISHOP, S. C., FLEMING, R. H., MCCORMACK, H. A., FLOCK, D. K. and WHITEHEAD, C. C. (2000): Inheritance of bone characteristics affecting osteoporosis in laying hens. *British Poultry Science*. 41, 33-40.



# Keel bone radiographic density is genetically correlated with fractures

**Table 5.** Genetic correlations (with standard errors) between index traits and bone fracture incidences

	Body weight	Keel RD	Humeral strength	Tibial strength	Bone Index
Presence/absence of fractures	-0.25 (0.28)	-0.69 (0.30)	-0.86 (0.32)	-0.69 (0.32)	-0.89 (0.36)
Total number of fractures	-0.18 (0.26)	-0.57 (0.28)	-0.78 (0.29)	-0.65 (0.28)	-0.64 (0.31)

**The message is that by improving or measuring skeletal properties other than the keel, it is possible to reduce keel bone damage.**



**Keel bone damage causes are multifactorial.**

**But for genetic and nutritional interventions, using non-keel bone measurements may be effective.**

**Keel bone damage could be viewed as one symptom of overall deficits in bone quality.**

## Timetable for today

## But plenty time in the next 3.5 years

10:20	Introduction	Ian Dunn
10:30	Assessment of bone quality and damage	Heather McCormack
10:45	Improving and validating keel bone palpation	Ariane Stratmann
11:00	Radiographic evaluation of keel bone damage in laying hens	Sarah Baur
11:15	Radiographic examination of deformities and fractures of keel bones in laying hens	Beryl Eusemann
11:30	Keel bone damage, clues from genetic assessment	Björn Andersson
11:45	Physico-chemical assessment of avian bone	Alejandro Navarro