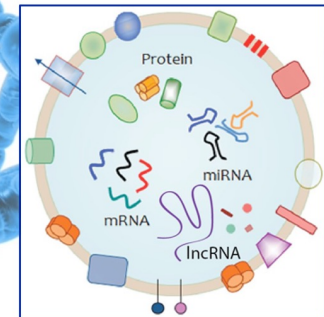
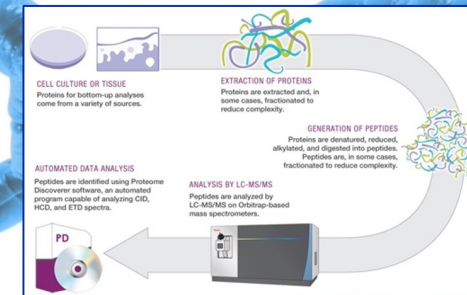
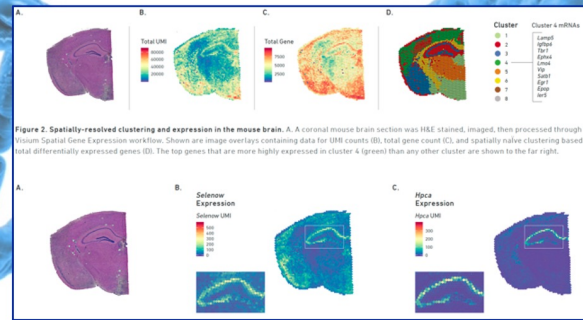
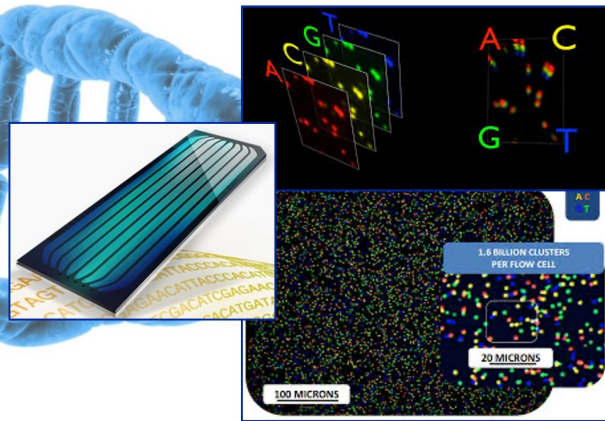


Overview of ongoing research projects



Stefan Bauersachs

University of Zurich^{UZH}, Vetsuisse Faculty

Institute of Veterinary Anatomy, AG Bauersachs, Functional Genomics

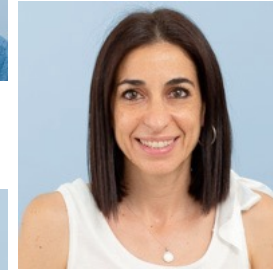
AgroVet-Strickhof, Lindau (ZH), Switzerland

Group Members

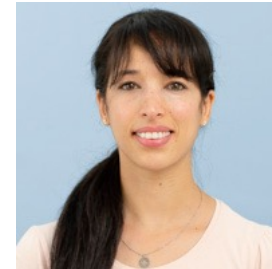
PD Dr. Stefan Bauersachs, group leader



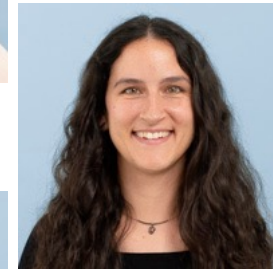
Dr. Carmen Alminaña Brines (PhD), research scientist



Dr. Meriem Hamdi, PhD, postdoc (MSCA-IF)



Alba Rudolf Vegas, PhD student



Siyka Bozukova, lab technician



Research topics and approaches of ongoing projects

Gene expression alterations at RNA and protein level as drivers of impaired fertility:

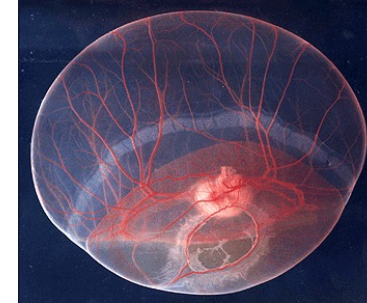
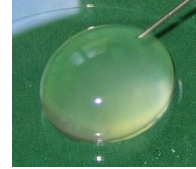
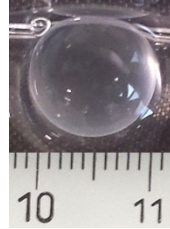
- Female fertility: endometrial alterations in RNA and protein expression, uterine microbiome
- Male fertility: spermatozoa and seminal plasma
- Embryo-maternal interactions during the preimplantation phase:
signals from endometrium, embryo and through extracellular vesicles (EVs)
- Embryo: biomarkers of embryo quality (biotechnologies, i.e., vitrification and IVP)
- Biomarkers for infertility, disease, and stress in cell free circulating and EVs

Project 1:

**Cell type-specific endometrial transcriptome analysis
and uterine exosome communication:
New approaches to decipher the embryo-maternal cross-
talk during maternal recognition of pregnancy in the mare**

Supported by the Swiss National Science Foundation, Project 31003A_173171 (2018-2022) and
Foundation Pro Pferd (Zurich), Project 2018-03 (2018-2021)

Embryo-maternal interactions during initial recognition of pregnancy in the mare



© Doug Antczak

Conceptus secretions:

E2, PGE₂, etc. IFND

Arrival in the uterus

Implantation,
epitheliochorial placentation



Migration throughout the whole uterus

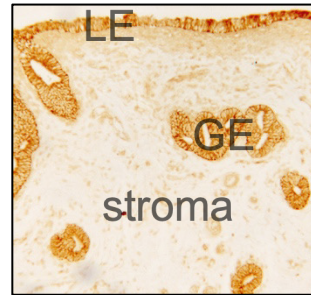
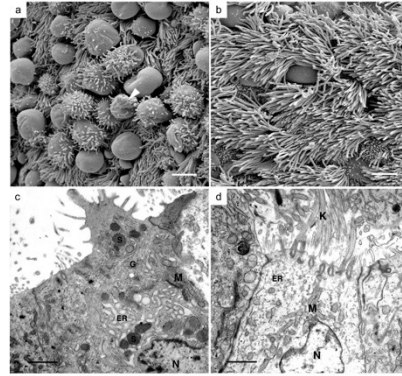
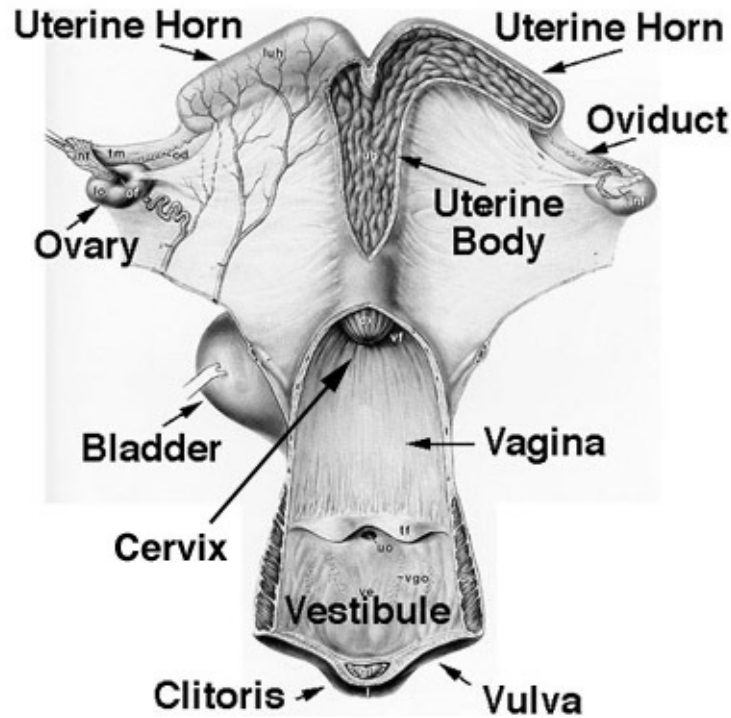
Fixation at the
base of one of
the uterine horns

Sampling on Days 10, 11, 12, 13

MRP: maternal recognition of pregnancy

Embryo-maternal interactions during maternal recognition of pregnancy

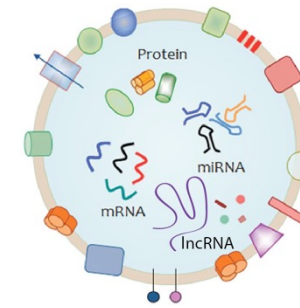
Reproductive tract



LCM-RNA-seq

Oviductal/ uterine fluid

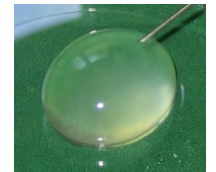
Extracellular vesicles



Exchange of various
molecules

RNA-seq
Proteomics

Embryo/ conceptus



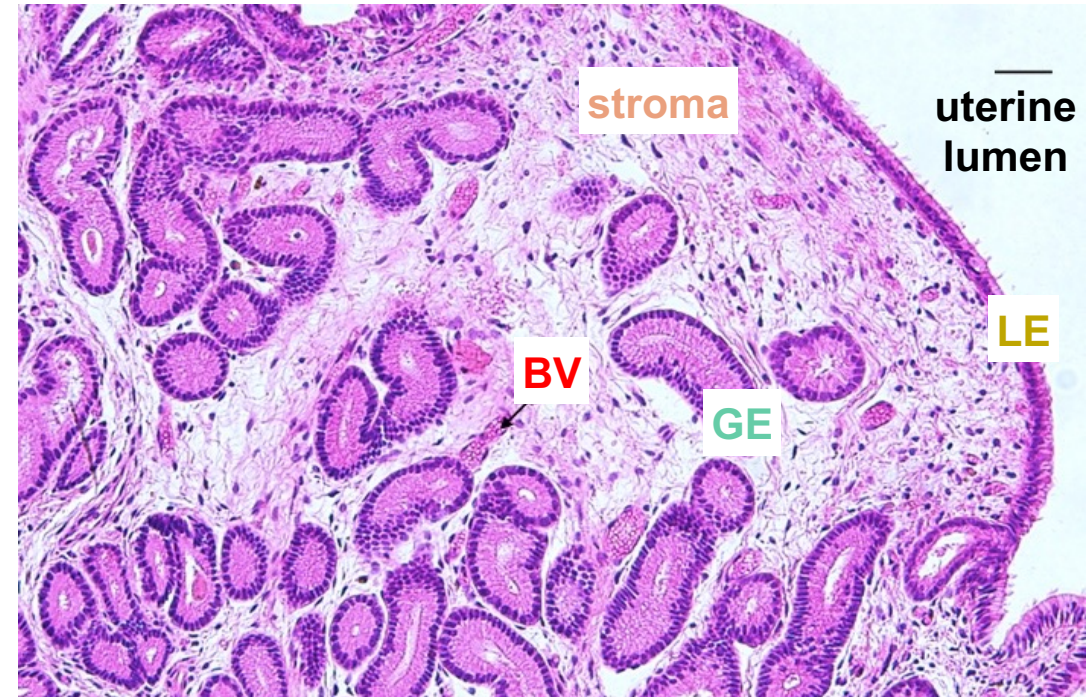
RNA-seq
Proteomics

Maternal side

Embryo side

The endometrium as the most important maternal tissue in embryo-maternal interactions

- Support of embryonic development by providing nutrients and growth factors
- Maternal recognition of pregnancy
- Preparation for implantation and placentation

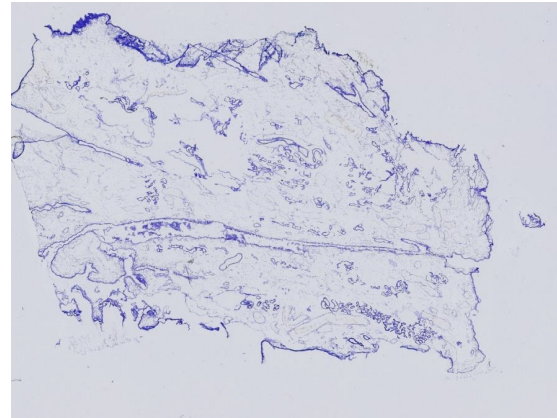


LE luminal epithelium

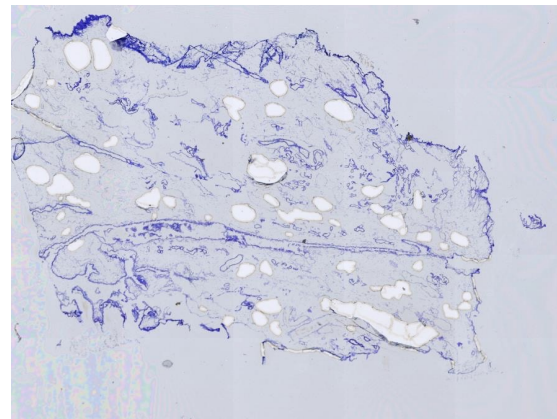
GE glandular epithelium

BV blood vessels

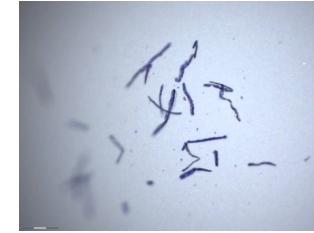
Isolation of endometrial compartments by Laser Capture Microdissection (LCM)



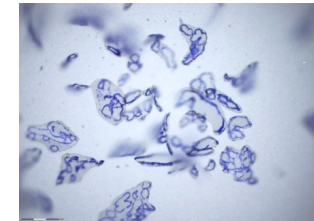
Before LCM



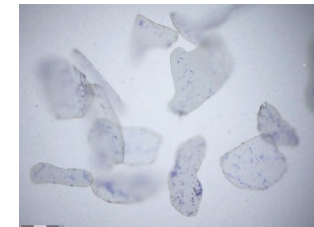
After LCM



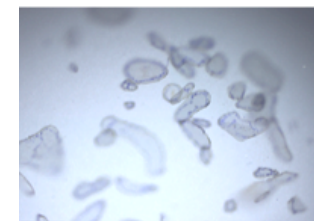
Luminal Epithelium (LE)



Glandular Epithelium (GE)



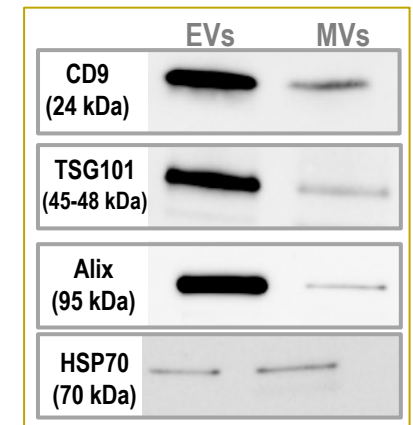
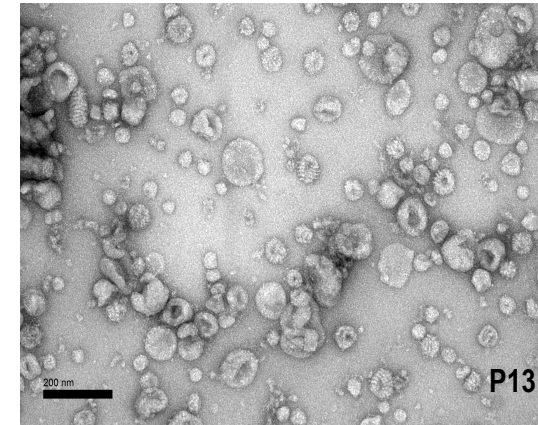
Stroma (S)



Blood vessels (BV)

Collection and characterization of uterine EVs

- EVs isolation from small-volume uterine lavage (70-80 ml)
- Characterization of isolated EVs by transmission electron microscopy (TEM), Western blot
- Analysis of molecular content: mass spectrometry proteomics, RNA sequencing



Project 2:

The uterine Microbiota and Fertility in the mare: Why the bacterial composition matters?

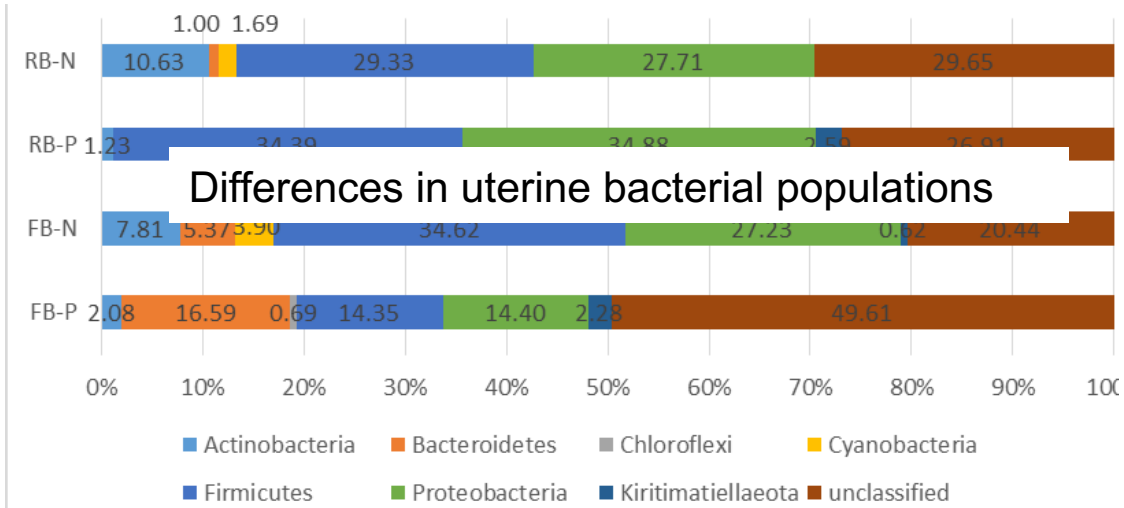
Supported by the Swiss National Science Foundation, Project 310030_200534 (2021-2025)

Objectives

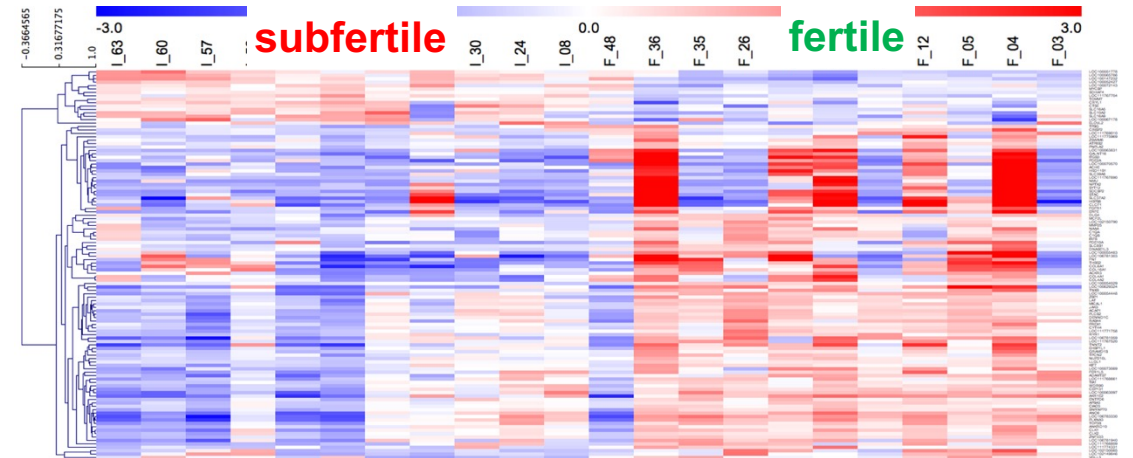
1. To determine changes in the uterine microbiome depending on cycle and pregnancy status.
2. To determine the relation of uterine microbiota composition and mare fertility by comparing the uterine microbiota in fertile and subfertile mares and their uterine EVs.
3. To determine the functional impact on the endometrium by examining mechanisms of action of uterine microbiota-host interaction (alterations in endometrium gene expression, epithelial barrier integrity, and EVs as novel drivers of infertility).

Research approaches

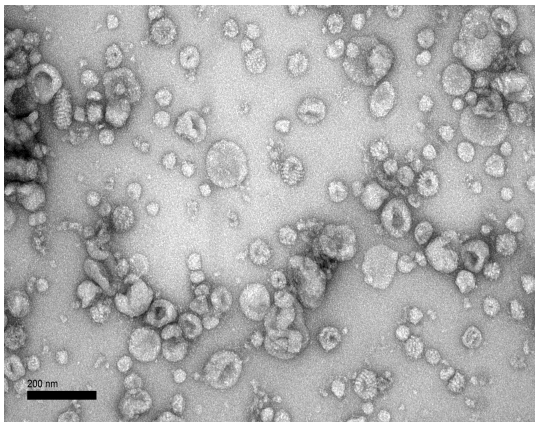
Microbiome analysis using 16S rRNA gene sequencing



RNA sequencing – uterine cytobrush and spatial transcriptomics of endometrial biopsies

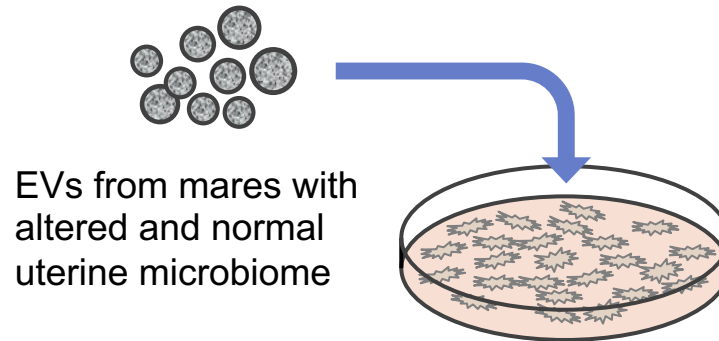


Uterine EVs RNA and protein cargo



- Low-input RNA-seq
- Proteomics

Primary equine endometrial epithelial cell (eEEC) culture

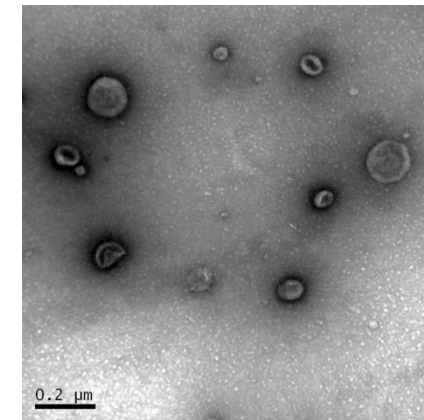
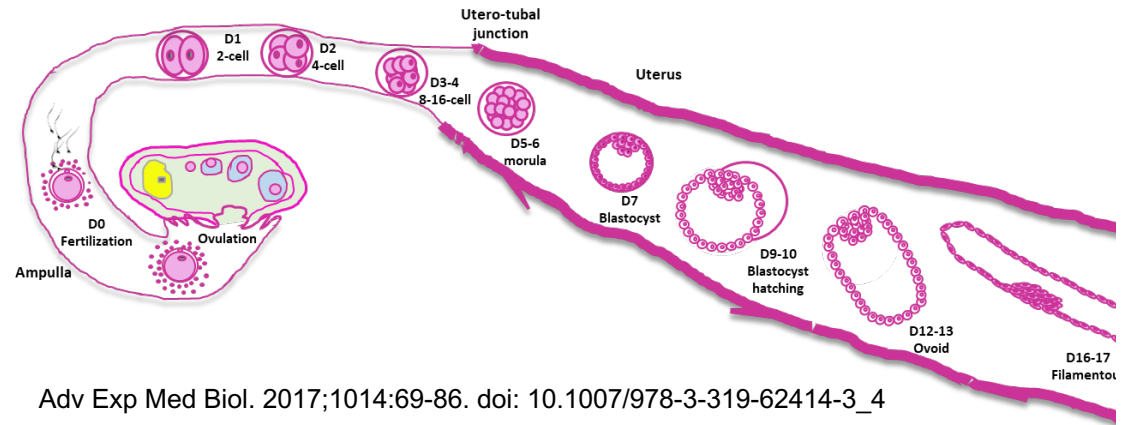


- Analysis of EVs uptake
- Response to EVs in eEECs

Project 3:

Exosomes as a new strategy in Assisted Reproductive Technologies in cattle: tracing maternal nanomessengers to improve pregnancy outcomes

- Dr. Meriem Hamdi, EU Horizon 2020 Marie Skłodowska Curie Postdoctoral Fellowship
- Focus on early embryonic development and embryo-maternal communication
- Exosomes as a new strategy in Assisted Reproductive Technologies (ART)
- Decoding the exosomal messages between mother and embryo to improve pregnancy outcomes in cattle
- Analysis of EVs molecular cargo derived from good and poor quality embryos before and after genome activation *in vitro* (co-culture with oviduct epithelial cells) and *in vivo*



This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No. 897316

Project 4:

Effect of aircraft noise exposure on livestock performance

- Analysis of stress markers in milk and in milk EVs
- In collaboration with Prof. Rösli, Swiss Tropical Health Institute Basel, correlation of noise measurements with AgroVet-Strickhof records of dairy cows



Supported by Bundesamt für Umwelt (BAFU)



Research Station AgroVet-Strickhof



**Thank you for your
attention!!!**