# Applied Genetic Evaluation Of Livestock

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01.04.2019

# Program

| Week | Date | Topic |
|---|---|---|
| 1 | 01.04 | Introduction |
| 2 | 08.04 | Suisag and The Swiss Pig Breeding Program |
| 3 | 15.04 | Model Selection |
| 4 | 22.04 | **Easter Monday** |
| 5 | 29.04 | Genetic Groups |
| 6 | 06.05 | Longitudinal Data |
| 7 | 13.05 | Excursion to Braunvieh Schweiz and Qualitas in Zug |
| 8 | 20.05 | Questions and Test Exams |
| 9 | 27.05 | Final Exams |

# Excursion

- Date: 13.05.2019
- Time: 07:45 - 10
- Topics
  - Lucas Casanova: Braunvieh Schweiz
  - Jürg Moll: Qualitas AG

# Course Objectives

The students

- understand the theoretical background and the practical application of the prediction of breeding values in Swiss cattle breeding, in pigs, sheeps and goats.
- know how to interpret predicted breeding values.

$\rightarrow$ What is the meaning of a predicted breeding value of $-900$ kg for milk yield

$\rightarrow$ What is the difference between production and breeding

# Further Reading

- Willam und Simianer: Tierzucht - Grundwissen Bachelor (Ulmer, UTB 3526 2011). This book gives an introduction into evolution, livestock production and breeding programs.
- Falconer and Mackay: Introduction to Quantitative Genetics (Longman). The de-facto standard in the area of quantitative genetics uses many examples from experimental research to illustrate the concepts of quantitative genetics.
- Mrode: Linear Models for the Prediction of Animal Breeding Values (CABI Publishing, 2005). The main focus is on prediction of breeding values using different models.

# Terminology

- Livestock breeding versus animal husbandry: no difference made
- Breeding (in German: *Zucht*) used in different contexts with different meanings
- Science:

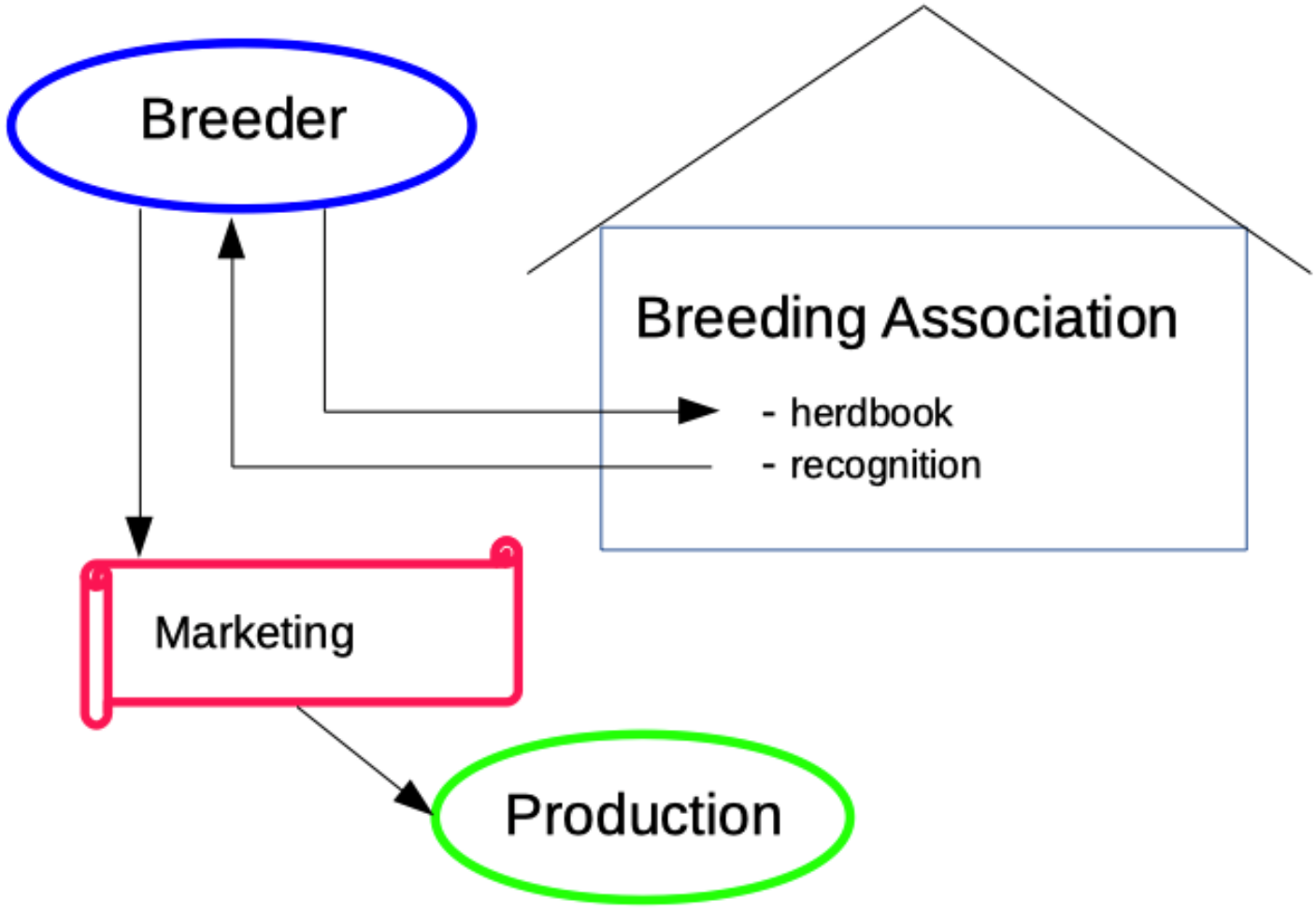
  *"Selection and Mating of parents are used such that offspring generations are closer to a defined goal."*

- Distinction between
  - livestock breeding and production
  - cattle breeding and milk or beef production
  - pig breeding and pork production and
  - chicken breeding and egg producers

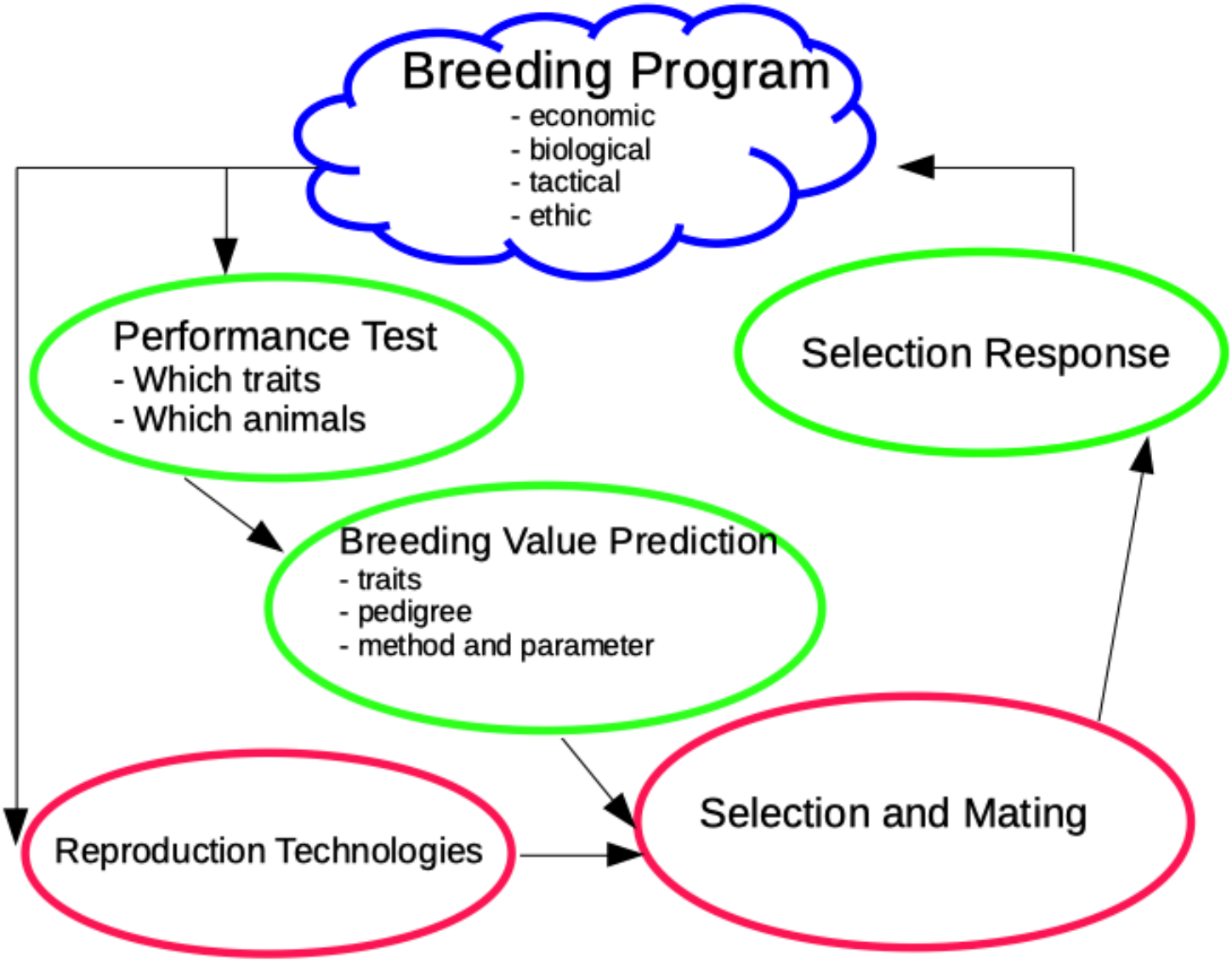
# History

- Formations of breeding organisation (BO)
- Tasks of BO: herdbooks and certification
- Crisis at beginning of $20^{th}$ century lead to federal regulations
- Developments of technologies
  - Reproduction
  - Molecular biology
  - Computer science

# Breeding Organisations



# Breeding Programs



# Parts of Breeding Program

- Applied prediction of breeding values is a part of the breeding program
- Design and planning of a breeding program requires to answer the questions
  - What goal do we want to achieve
  - What measures do we want to use to achieve the goal

# Types of Breeding Programs

Two types of breeding programs

1. Focus on **selection response**
   - countries with limited resources
   - big farms or big companies
2. Focus on clients and services
   - cattle and pig breeding of developed countries
   - economic interest of companies and farms

# Breeding Goals

Types of breeding goals

- economic
- biological
- tactical
- ethical

Breeding goals might be formulated in different ways

- **political**: description of idealized image of future animal. Often conflicting and not verifiable
- **scientific**: mathematical description of direction of desired change. Measurable via selection response

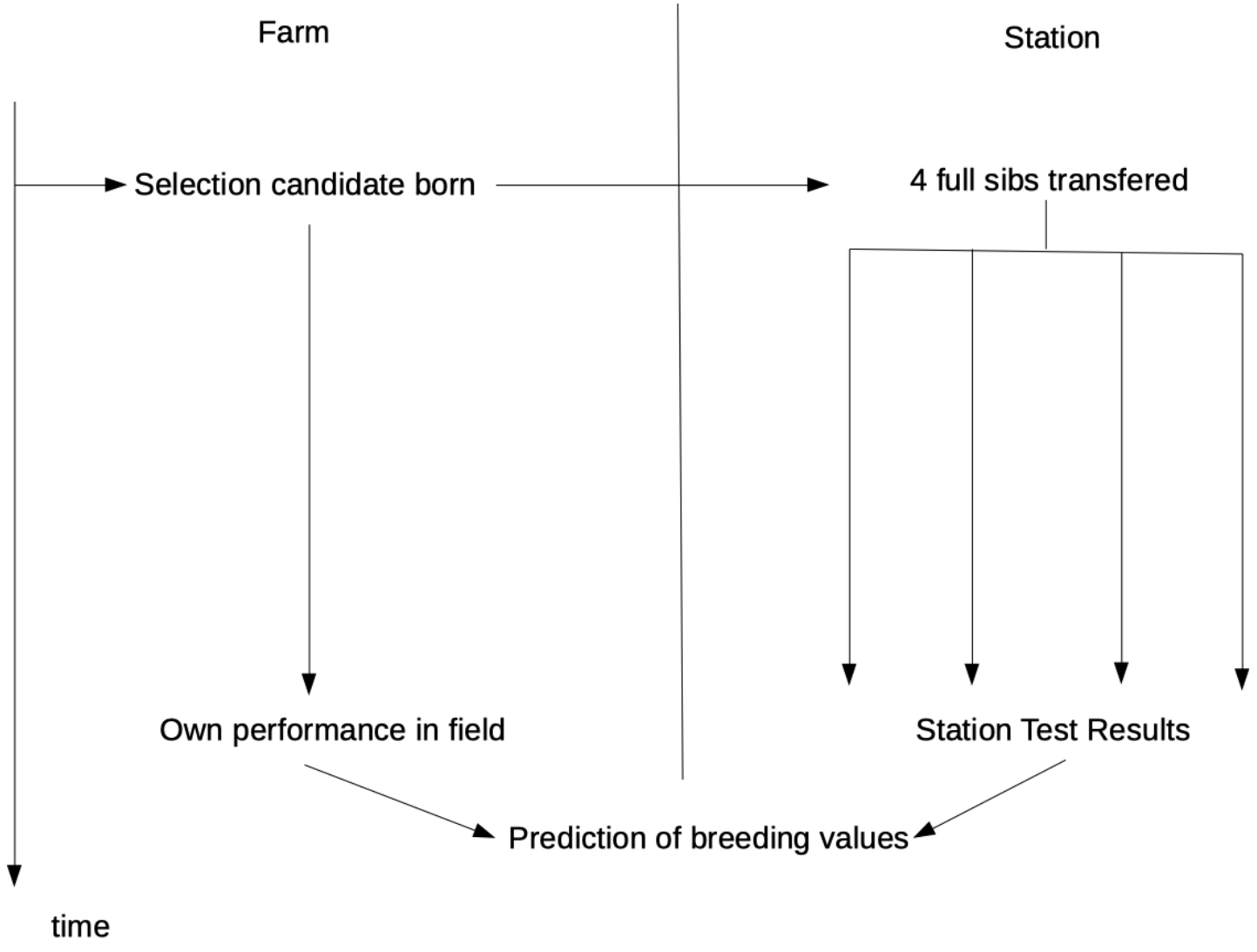
# Performance Testing

- Basic question: What trait is measured when for which animals
- Breeding should be based on data
- Quality of derived parameters (heritability, predicted breeding values) depend on accuracy of collected data
- Data collection used for performance testing often started for different reasons
  - milk sample testing: quality of product
  - station testing in pigs: correction of environment

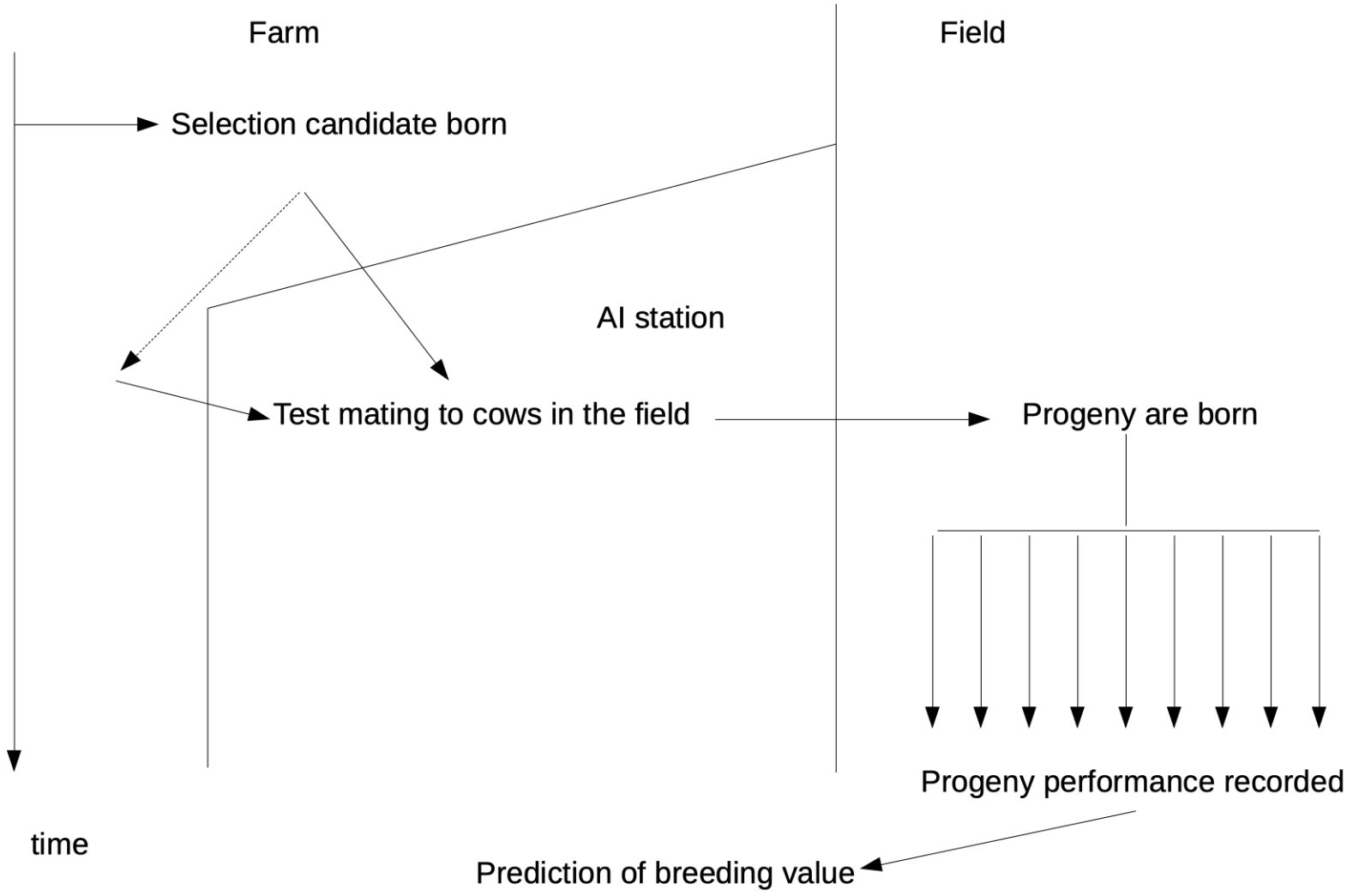
# Classification of Performance Tests

- Place
  - Station
  - Field
- Relationship between selection candidate and tested animal
  - own performance record
  - full-sib
  - progeny
- Traits
  - should have genetic variation
  - economic importance
  - measurable better than subjectively observed

# Examples: Pigs



# Examples: Cattle



# Prediction Of Breeding Values

- Done in most breeding programs
- Federal regulation
- Performance tests much more expensive
- Different intervals
  - cattle: three times per year
  - pigs: nightly or weekly

# Progress In Technologies

- Reproduction - AI
  - disease prevention
  - number of progeny per sire increased
  - better comparisons between herds
  - Future: more development on female side
- Molecular Biology
  - cheap and efficient large-scale genotyping
  - sequencing with more accuracy
- Computer Science
  - efficient evaluation of large amounts of data
  - big data technologies - continuous monitoring

# Differences Of BP Between Species

Breeding programs (BP) for different species have different structure

- **hierarchical**: pigs and chicken
- **flat**: cattle and horse

# Hierarchical Structure