Pig Science - Breeding

Peter von Rohr

2023-03-15

Program

Datum	Day	Room	Time	Dozent	Topic
22.02.23	Wednesday	LFW B2	8:15 - 10	SN	Introduction, Genetics
01.03.23	Wednesday	LFW B2	8:15 - 10	SN	Genetics
08.03.23	Wednesday	LFW B2	8:15 - 10	SN	Genetics
15.03.23	Wednesday	LFW B2	8:15 - 10	PvR	Breeding
22.03.23	Wednesday	LFW B2	8:15 - 10	SN/PvR	**Student presentations 1**
29.03.23	Wednesday	LFW B2	8:15 - 10	SN/GB	**Student presentations 2**
05.04.23	Wednesday	LFW B2	8:15 - 10	GB	Feeding & Meat Quality
12.04.23	**Easter break**				
19.04.23	Wednesday			PVR	Breeding
21.04.23	**Friday**	**Excursion Agrovet Strickhof**			**Pig housing, constitution**
26.04.23	Wednesday	LFW B2	8:15 - 10	PVR	Breeding
03.05.23	Wednesday	LFW B2	8:15 - 10	GB	Feeding & Meat Quality
10.05.23	Wednesday	LFW B2	8:15 - 10	GB	Feeding & Meat Quality
17.05.23	Wednesday	LFW B2	8:15 - 10	CK	Sustainable pigs
24.05.23	Wednesday	**No lecture**			
31.05.23	Wednesday	LFW B2	8:15 - 10	SN	**Exam**

Program - Breeding

Week	Date	Topic
1	2023/03/15	Extension of Breeding Programs
2	2023/04/19	Genomic Selection in Pig Breeding
3	2023/04/26	Breeding Program via Aggregate Genotype

Information

- Lecturer: S. Neuenschwander, C. Kasper, G. Bee, P. von Rohr
- Date: Wednesday 8-10
- Mode: in person
- Room: LFW B2
- Moodle: https://moodle-app2.let.ethz.ch/course/view.php?id=19265
- Website: https://charlotte-ngs.github.io/psbss2023
- Questions: during the lecture and during the exercise hour or via e-mail
  - Peter von Rohr (peter.vonrohr at usys.ethz.ch)

Course Objectives

The students

- understand the theoretical background and the practical application of the prediction of breeding values in a livestock breeding
- know how to interpret predicted breeding values.

$\rightarrow$ What is the meaning of a predicted aggregate genotype -9 index points

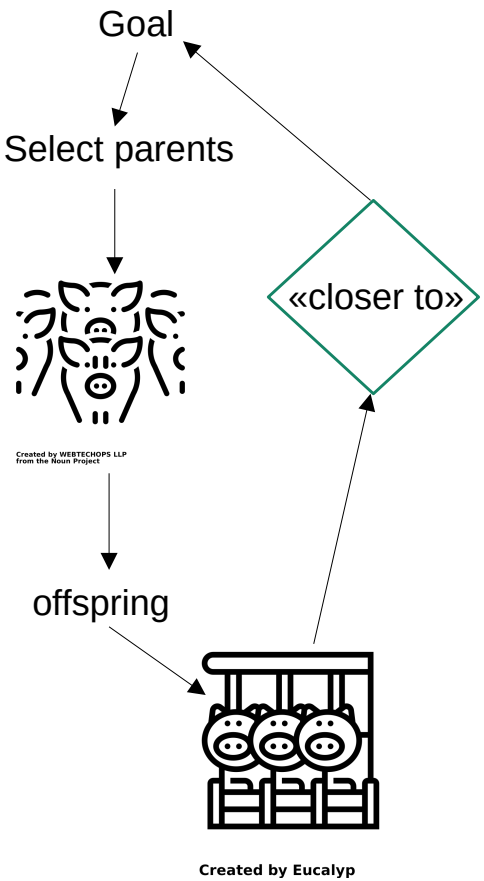
$\rightarrow$ What is the difference between production and breeding

Further Reading

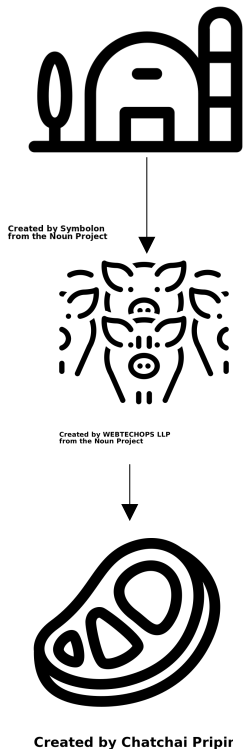
- Willam und Simianer: Tierzucht - Grundwissen Bachelor (Ulmer, UTB 3526 2011). This book gives an introduction into evolution, livestock production and breeding programs.
- Falconer and Mackay: Introduction to Quantitative Genetics (Longman). The de-facto standard in the area of quantitative genetics 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

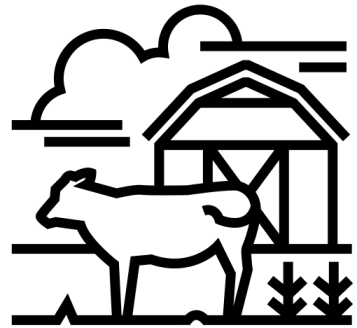
Breeding



Production



Husbandry



Created by Creative Mania from the Noun Project

… and into many other products according to https://www.ted.com/talks/christien_meindertsma_how_pig_parts_make_the_world_turn

Scientific Definition

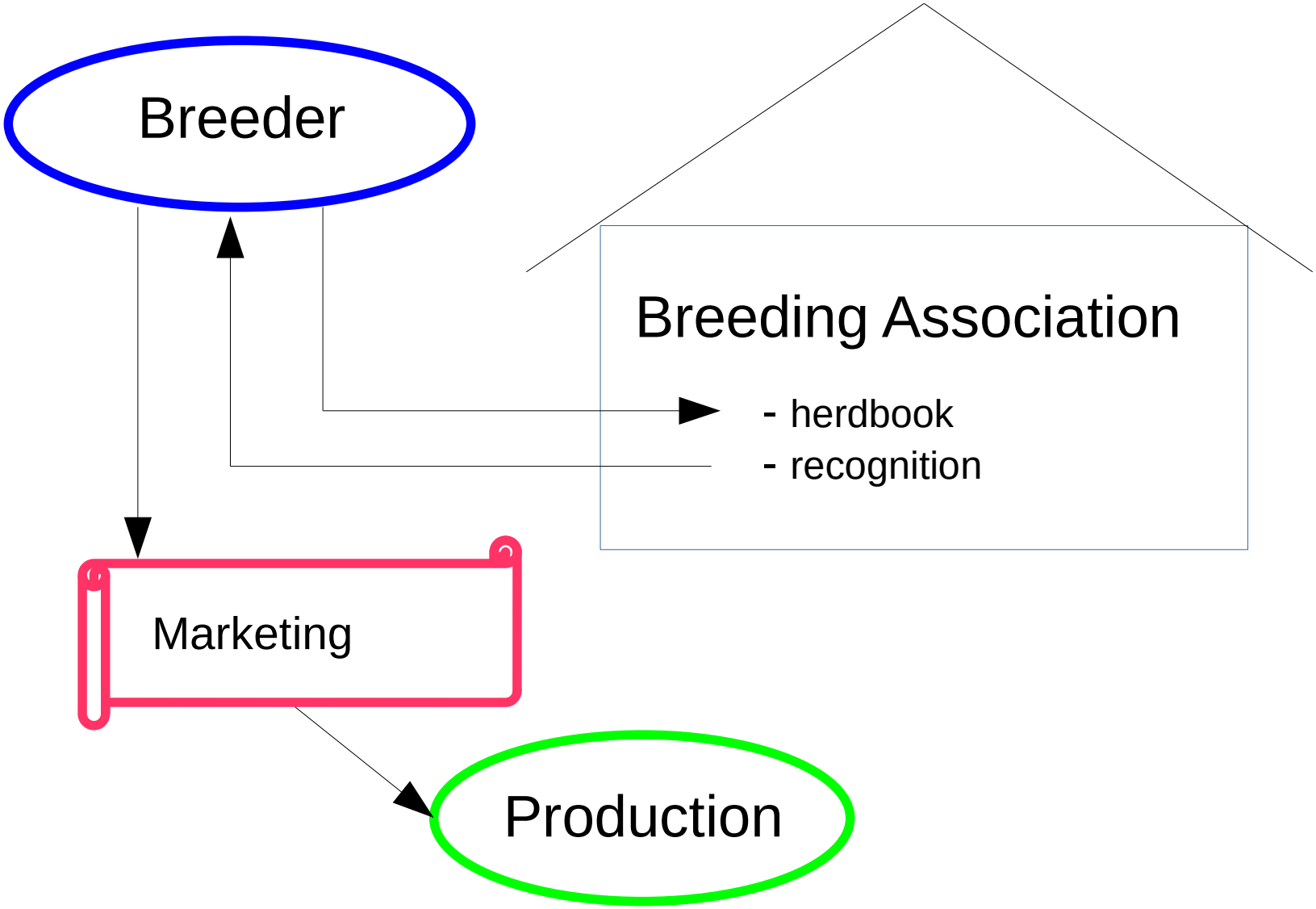
"Selection and Mating of parents are used such that offspring generations are closer to a defined goal."

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

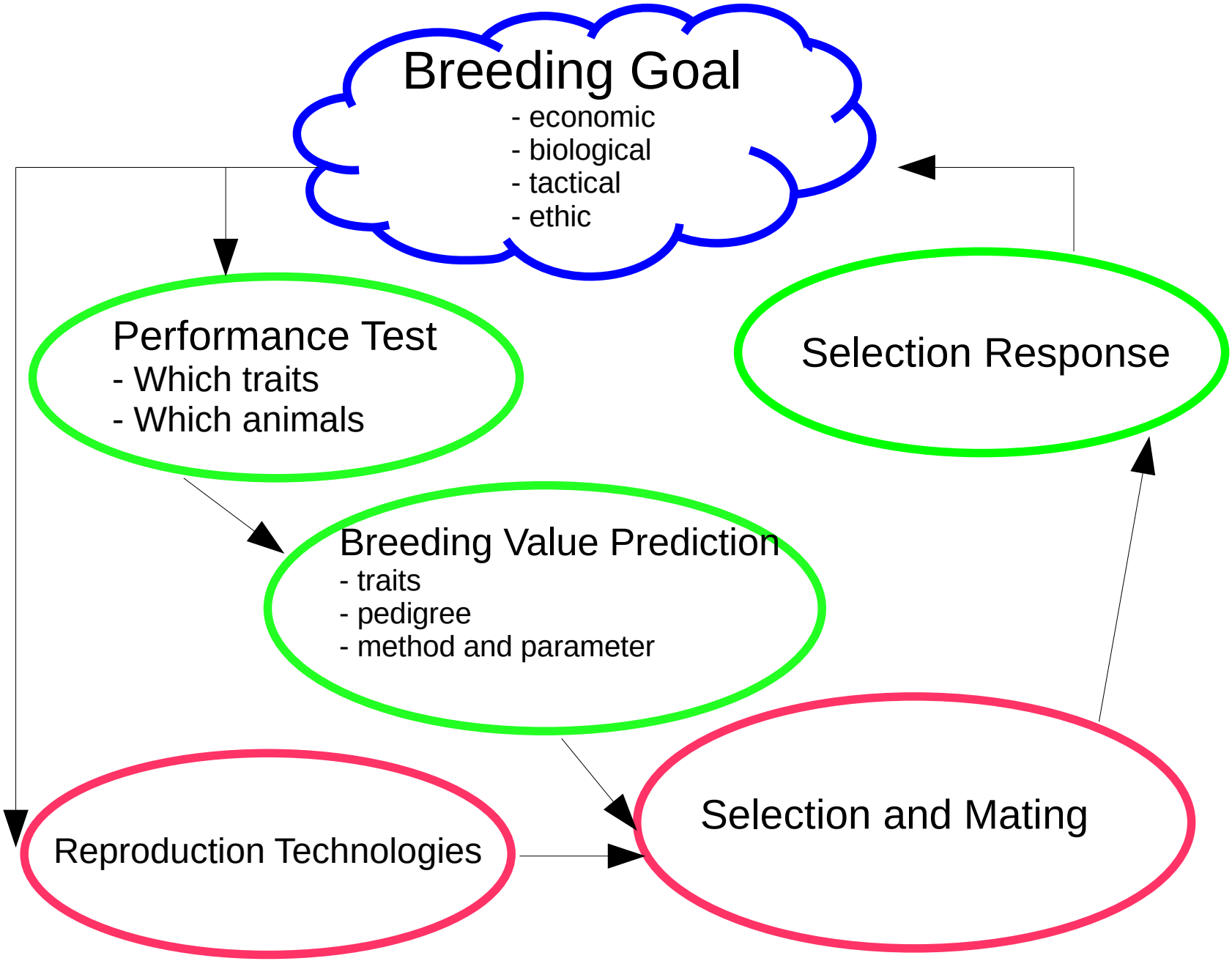
History

- 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

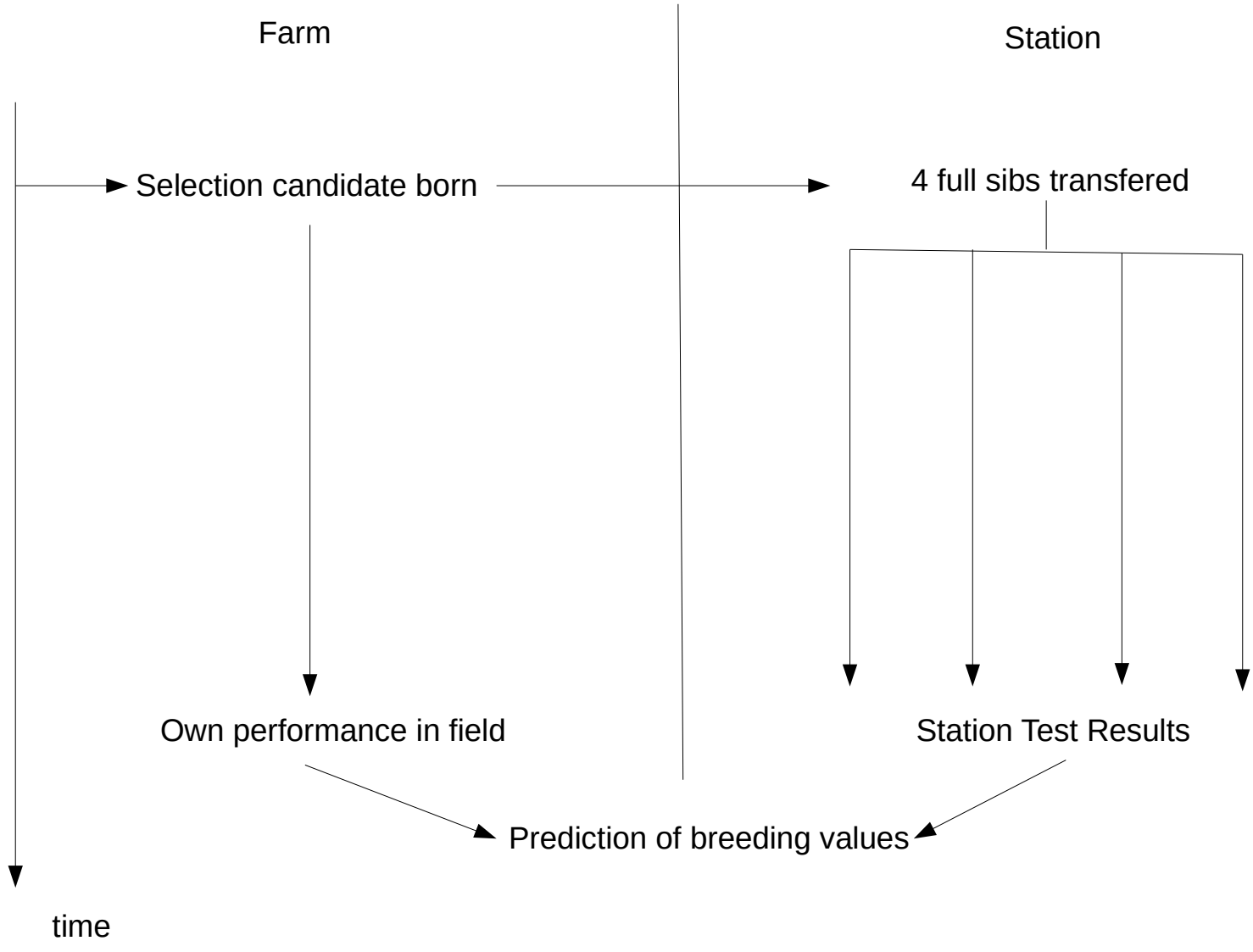
Performance Testing

- 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

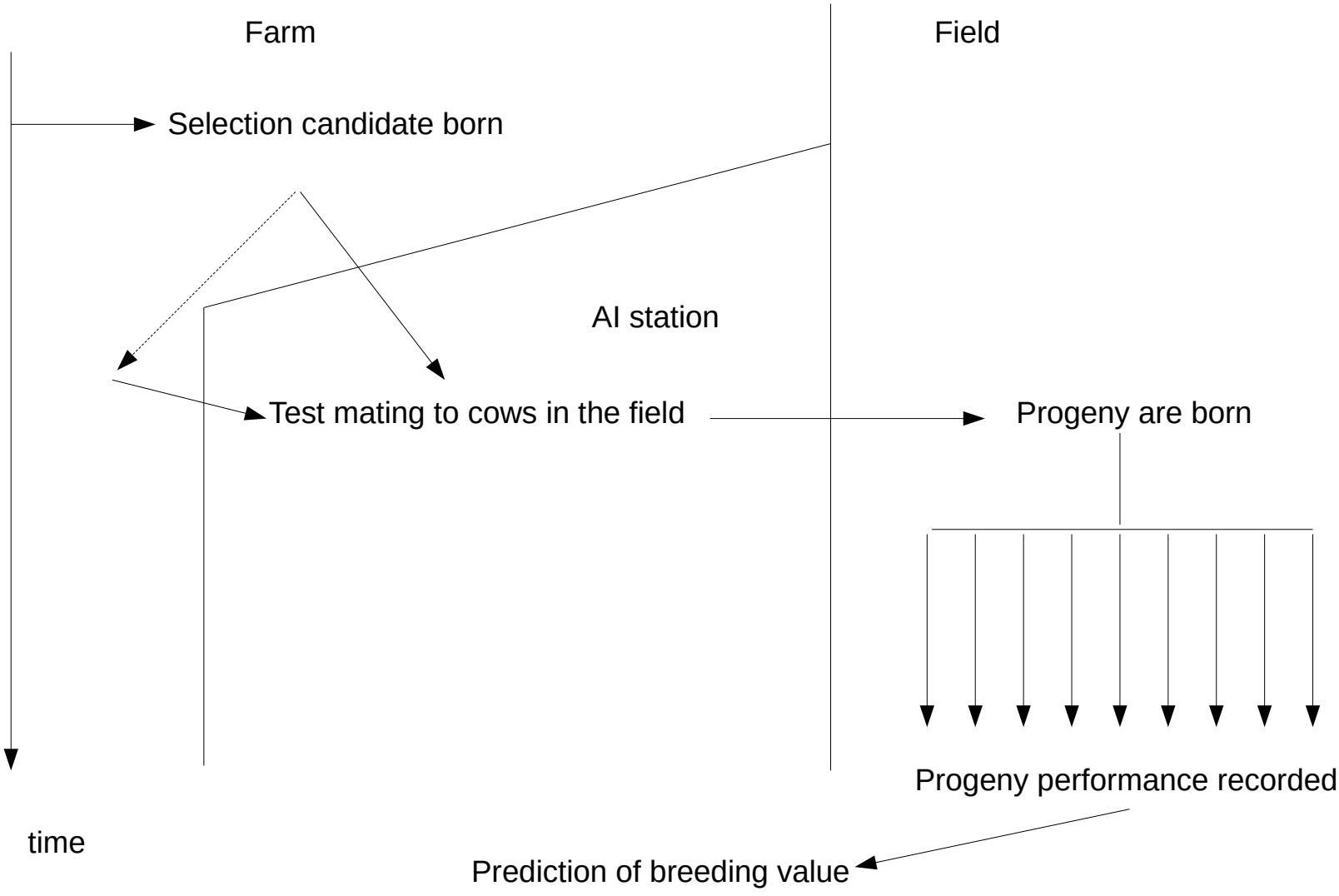
Classification of Performance Tests

- 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

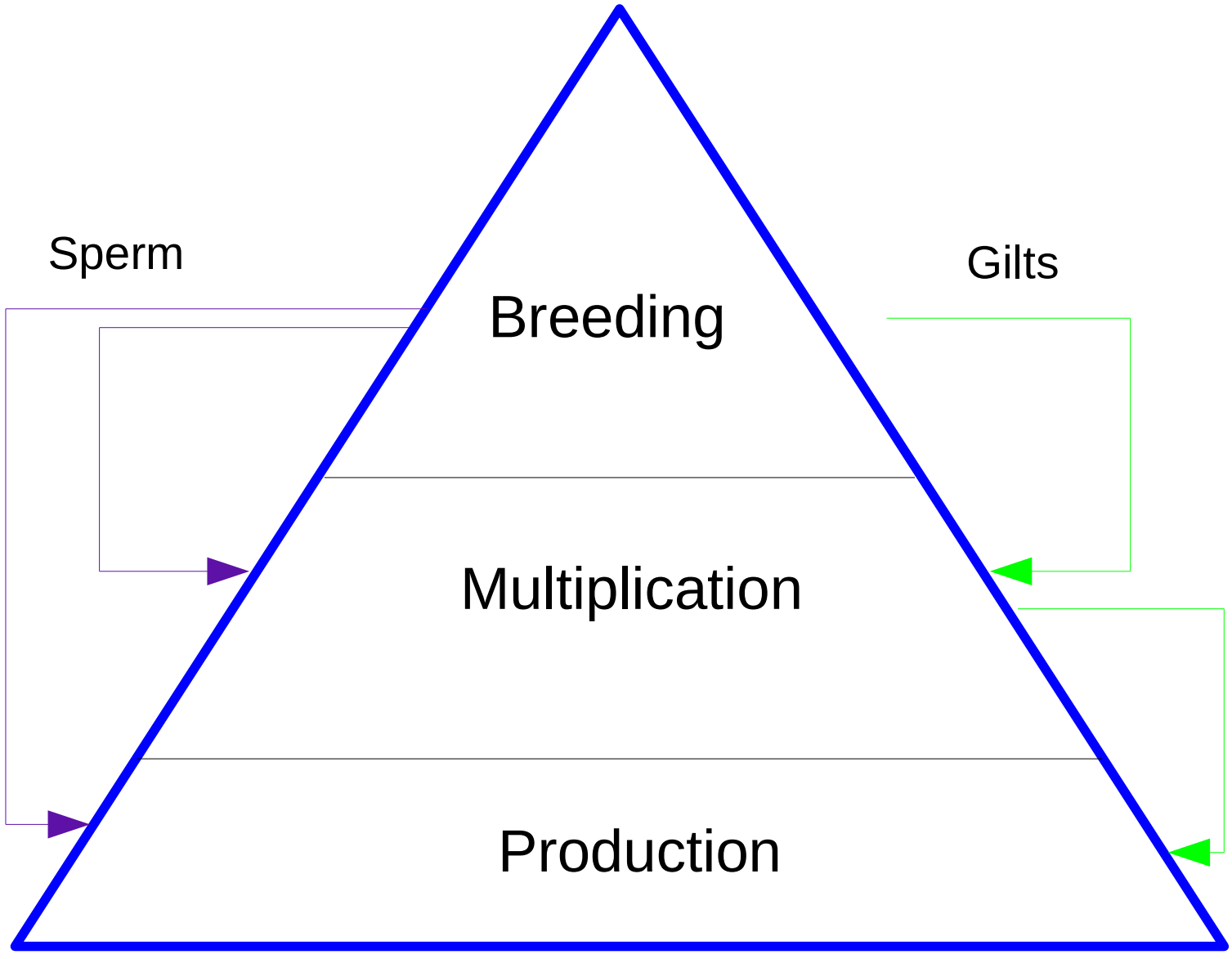
- Reproduction - AI
  - disease prevention
  - number of progeny per sire increased
  - better comparisons between herds
  - Future: more development on female side
- Molecular Biology
  - cheap and efficient large-scale genotyping
  - sequencing with more accuracy
- Computer Science
  - efficient evaluation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



Monolithic Structure