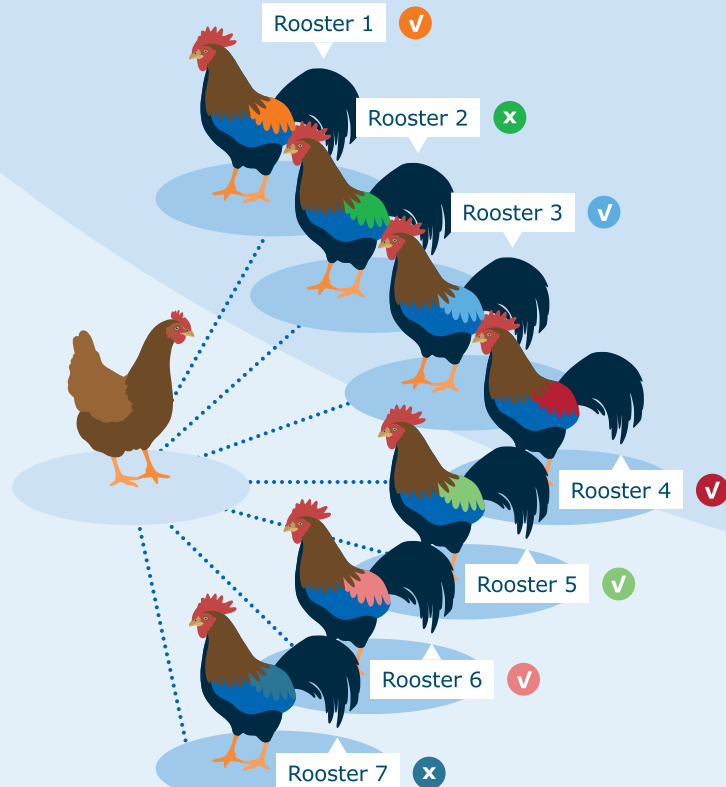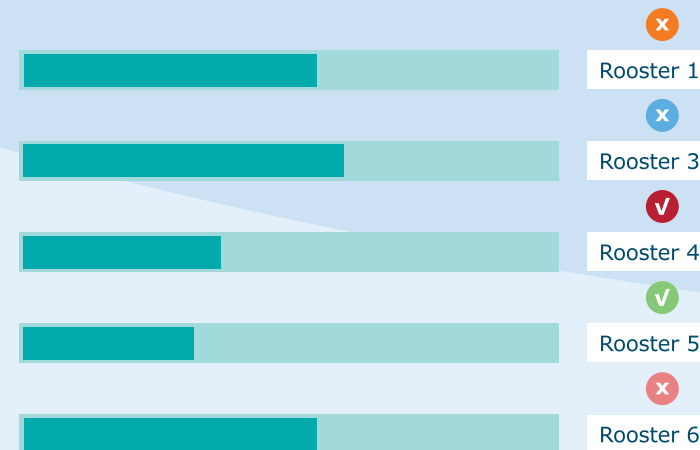# How to deal with inbreeding and relationship for breeders and owners
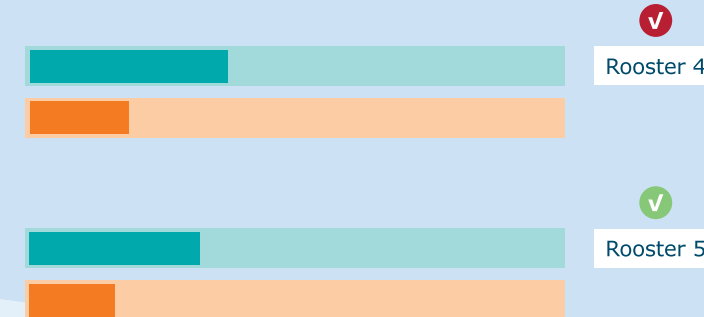
Inbreeding can cause genetic defects and affect health *(see infographic 1)*. When breeding an animal it is important to take inbreeding and relationship into account.

**F** **Inbreeding coefficient**
The DNA % of an animal that descends from common ancestors. It ranges from 0 to 100%.

r **Relationship coefficient**
The DNA % of two different animals descending from the same ancestor.

MK **Mean Kinship (MK)**
Average kinship of an animal with all other animals in the population. The lower its MK, the more important an animal is for the diversity of the breed.

Rooster 1 ✓
Rooster 2 ✗
Rooster 3 ✓
Rooster 4 ✓
Rooster 5 ✓
Rooster 6 ✓
Rooster 7 ✗

✗ Not selected   ✓ Potential mate

Rooster 1 ✗
Rooster 3 ✗
Rooster 4 ✓
Rooster 5 ✓
Rooster 6 ✗

● Relationship between rooster and hen

Rooster 4 ✓
Rooster 5 ✓

● Relationship between rooster and hen
● Inbreeding of offspring = half relationship parents
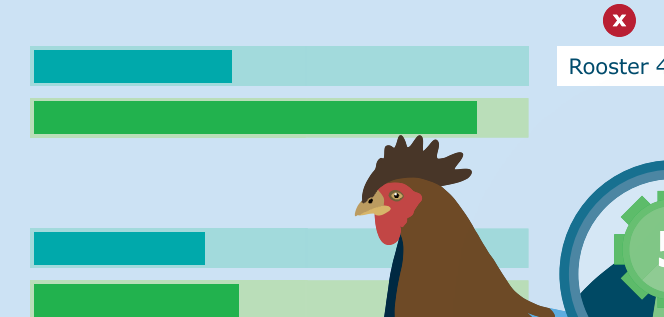
Rooster 4 ✗

● Relationship between rooster and hen
● Mean Kinship rooster with population

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1 Check which animals qualify as partner.

**Selecting animals for breeding.**
Not only inbreeding and relationship are important. Animals can also be eliminated because they do not fit the breeding goal, or for example have problems with health, behaviour, conformation or genetic defects. Always look for a balance between selection for the breeding goal, inbreeding and relationship.

2 Determine relationship.

Calculate relationship between two animals.
The **(r)** relationship and **(F)** inbreeding coefficients can be calculated if the pedigree is known. Inbreeding is half the relationship of the parents.
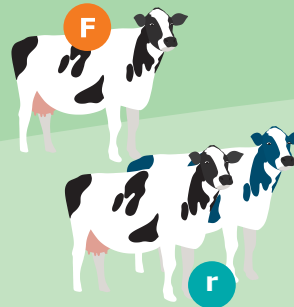
3 Choose animals with low relationship.
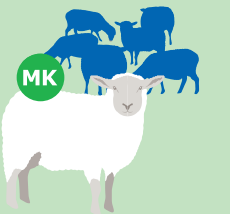
What if parents are unknown?
If ancestors are unknown, you cannot calculate relationship. Look for other indications of relationship. For example, animals of the same breeder are more likely to have a higher relationship.
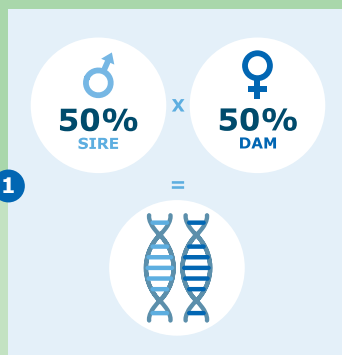
4 Look at the Mean Kinship.

When is inbreeding too high?
A limit is difficult to determine. As a rule of thumb: the better the pedigree, the more ancestors are known, the higher the inbreeding. At least avoid common ancestors in the last three generations and choose animals with a low MK.
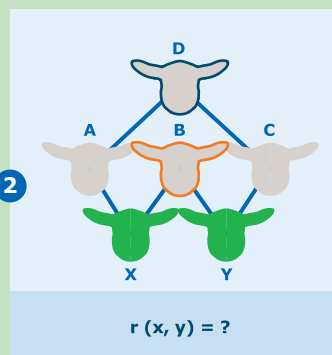

1
♂ 50% SIRE x ♀ 50% DAM
=
Basic rule: offspring receives 50% DNA from the mother and 50% from the father.
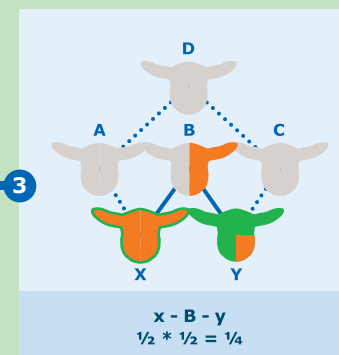
Easy to calculate with computer programs such as pedigree software.

2
r (x, y) = ?
Calculate relationship between animal X and animal Y. Search for all common ancestors.

Common ancestors: D and B

3
x - B - y
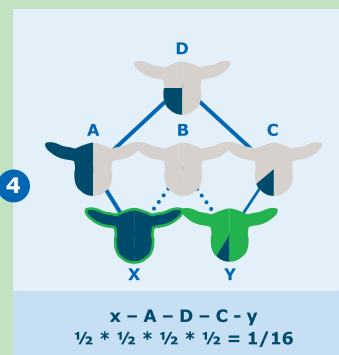½ * ½ = ¼
Count the steps from animal X to animal Y. Every step halves the relationship.

r Halfsiblings = 0.25

4
x – A – D – C – y
½ * ½ * ½ * ½ = 1/16
Do the same for every common ancestor.

r Half nephew/niece = 0.06125
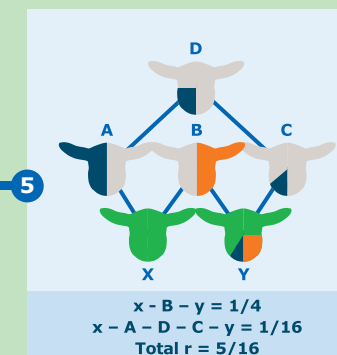
5
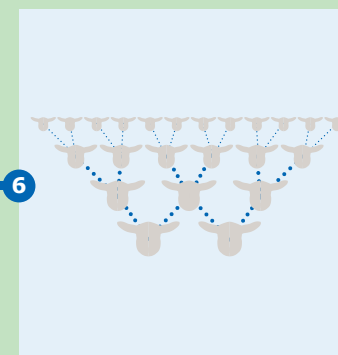x - B – y = 1/4
x – A – D – C – y = 1/16
Total r = 5/16
Sum all relationship coefficients for the total relationship coefficient between animal X and animal Y.

r Halfsiblings + nephew/niece = 0.3125

6
Apply to the whole pedigree, up to the founders.

r Increases with more ancestors

Pitfalls and misunderstandings.

? Do not mate inbred animals.
! **Inbreeding is not heritable.**

? Inbreeding should be banned.
! **All animals are inbred if you go back far enough.**

? Do not mate carriers of genetic defects.
! **All animals carry genetic defects.**

? Inbreeding is actually good to capture genetic traits.
! **Unintentionally genetic defects are captured as well.**