

4.2 Relationship and inbreeding, calculation examples and formulas

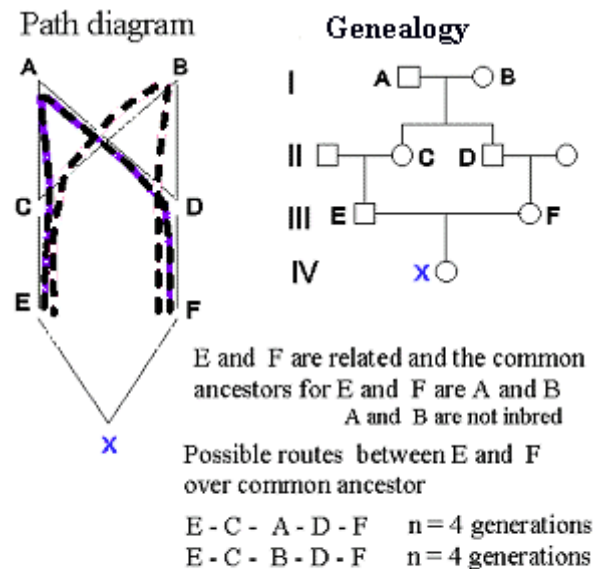
Related individuals can be put into a genealogical diagram. When calculating the coefficient of relationship and inbreeding it is easier to trace the individuals in the pedigree back to the common ancestors using a path diagram. Only individuals of significance for the inbreeding are referred to in the diagram. Which means that individuals that do not lead back to the common ancestors are excluded, see example in Figure 4.2.

The coefficient of relationships (a) is calculated by tracing all possible relations between the two parents through the common ancestors. Note the dotted lines in the figure. Also note that every single animal is being noted throughout the routes. Then the number of generations in each route is counted. The additive relationship can now be calculated as the sum of $1/2$ in the power of n (n = number of generations) as shown in Figure 4.2. F_A in the formula, Figure 4.3, points to the coefficient of inbreeding on a given common ancestor, in this case A and B, both having $F=0$.

Therefore the multiplication factor is 1 in both cases, and thus not shown in the calculations. The coefficient of inbreeding is $1/16$, which is half of the parents' coefficient of relationship.

Here n designates the number of generations between the parents X and Y, through a common ancestor, and F_A symbolizes the coefficient of inbreeding for the common ancestor belonging to a given route.

Figure 4.2. Example: Calculating relationship and inbreeding after first cousin mating.



$$a_{EF} = \sum (1/2)^n (1 + F_A) = (1/2)^4 + (1/2)^4 = 1/8$$

$$F_X = \frac{a_{EF}}{2} = 1/16$$

Figure 4.3. Formula for calculation of the coefficient of additive relationship between two animals, X and Y.

$$a_{XY} = \sum (1/2)^n (1 + F_A) \quad F_Z = \frac{a_{XY}}{2}$$