

**Selection effect** 

Modul no.3: Animal Breeding

Czech University of Life Sciences Prague, Faculty of Agrobiology, Food and Natural Resources





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#### **Selection effect**

The basic concept for selection in livestock, but also in domestic animals, is the so-called selection effect ( $\Delta G$ ),

## The selection effect is based on the additive action of genes.



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#### Heritability of body height in humans (F. Galton 1822-1911)

Generation	Deviations from the population mean								
Parent	-6,0	-4,5	-3,0	-1,5	0	+1,5	+3,0	+4,5	+5,0
offsprings	-4,0	-2,5	-1,5	-1,0	0	+1,0	+1,5	+2,0	+4,5

- The variation in individual traits is never passed on to the offspring in its whole, but only in part. In the offspring, an effort is made to return to the population average (genetic homeostasis - an effort to maintain an equilibrium state in the population).
- F. Galton found that, for body height, ⅔ of the variance is inherited on average (heritability number); the return to the population mean is ⅓ ( regression number).

These values are (according to F. Galton) different for each trait and each population



#### Selection effect (selection progress; response to selection; genetic gain)







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The selection effect (usually denoted  $(\Delta G)$ ) is the difference between the average performance of the offspring of the selected parents and the average performance of the population from which the parents were selected.



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#### Selection effect ( $\Delta G$ )

#### selection effect realized

$$\Delta G = \bar{y} - \bar{x}$$

#### selection effect expected

allows prediction of the performance of the subsequent generation.



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The fundamental fomulas for selection effect

$$\Delta G = \bar{d} \times h^{2}$$
$$\Delta G = ih^{2}\sigma_{P}$$
$$\Delta G = ir_{\hat{A}A}\sigma_{G}$$



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 $\sigma_{n}$ 



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#### **Intensity of selection**

Selection Selectio ratio basis 0,10 0,30 0,50 N = 2 0,56 N = 100,74 1,54 1,07 N = 50 1,70 1,14 0,80 1,75  $N = \infty$ 1,16 0,80

Practical impact !?



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# **Relative selection effect** $(\Delta G_{rel.})$ Expected selection effect expressed in units of standard phenotypic deviation

 $\Delta G_{rel.} = \frac{ih^2 \sigma_P}{\sigma_P} = i \times h^2$ 



#### **Selection effect per unit time** ( $\Delta G$ )

Expected selection effect per year instead of per generation



#### where *L* is the generations interval





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#### **Generation interval (L)**

- Generation interval:
  - is the average age of the parents at birth of their offspring that in their turn will produce the next generation of breeding animals.

## **Options for increasing the selection effect**

- Population size
  - The magnitude of the phenotypic standard deviation of the improved trait.
  - Heritability coefficient



#### **Options for increasing the selection effect**



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#### Another way of estimating the selection effect









## Thank you for your attention!

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#### Picture sources

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