

# Sustainable dog breeding

- challenges of small populations



Image: HRFI

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**Norsk  
Kennel Klub**

HUNDEEIERNES ORGANISASJON

Image: Anne Kathrine Dille



Image: P.I. Hegnes



Image: Ingrid Hemming



# Overview

- Sustainable dog breeding
- Selection
- Genetic diversity
  
- Loss of pm 1
- Patellar luxation





# Sustainable dog breeding

What is the goal?

- To maintain and improve the health, behaviour and conformation of the breed
  - Selecting the best and maintaining genetic variation
- Natural selection (eg. wolf) – selection for a sum of traits. High genetic variation.
- «Artificial» (manual) selection for specific traits – – vs natural selection



# Selection

- Selection of the best
  - Sounds easy...
- Disqualify individuals with evident health problems
- Which conditions/traits are unacceptable?
  - Traits that affect the pregnancy per se
  - Hereditary problems
- Which individuals are the best?
  - Show winners?
  - The friendly companion?
  - The one with the exquisite colour?
  - The good mother?



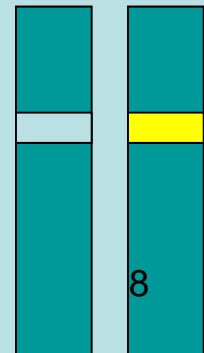
# Selection cont.

- ...selecting the best
- Strong selection for one/a few specific trait(s): quicker results
- What about other traits?
- Is the goal that all dogs should be alike (similar to the ideal dog described in the breed standard?)



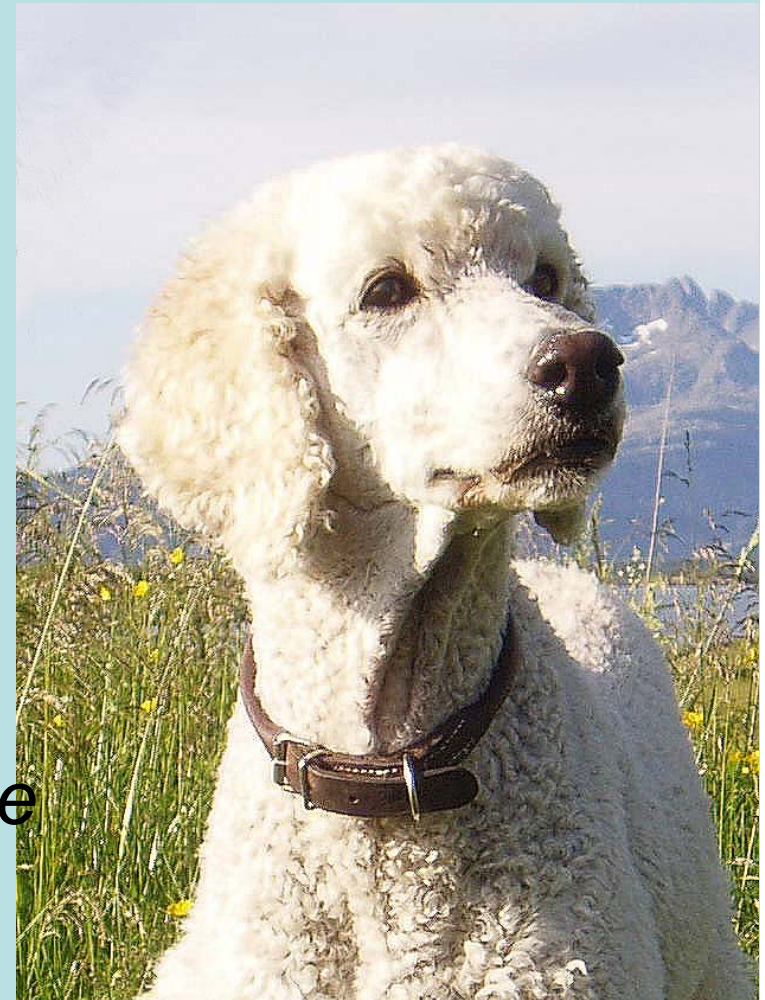
# Chromosomes, genes, alleles

- The genes inside the cells are arranged in *chromosomes*
- Chromosomes are paired (ie two of each)
- The two have genes for the same traits
- Alleles = possible "variants" in one gene locus (eg black-chocolate, diseased-healthy)





- The two chromosomes in a pair may have different alleles (eg one normal gene and a diseased gene)
- When there are the same alleles in one pair:  
*homozygous*
- When there are two different alleles in one pair:  
*heterozygous*
- – this why *dominant/recessive inheritance* is possible





# Genetic diversity

- The degree of *heterozygosity* in the population – how great proportion of the gene pairs have two different alleles
- Great genetic diversity:
  - High degree of variation in the population
  - Low degree of genetic relatedness
  - Generally lower risk of disease?
  - Unspecific effects, eg on immune system and fertility (inbreeding depression)



- Selection, progress ↑



- Genetic diversity ↓



Find the  
balance!

Select the  
best  
individuals for  
breeding



Maintain  
genetic  
variation

Maintain/improve  
the quality of the  
breed



# Hereditary or possibly hereditary conditions

*Should we:*

- Consider just the dog itself, or the line as a whole?
  - In every bloodline, there will be *something* negative to find
- Use one of the few normal dog from a bloodline with many diseased individuals?
- Use a defect dog if the line is generally healthy?
  - You may sometimes use a dog that is *less good* if the bloodline is very good, but you should not breed from a *defect* dog



# Inherited diseases in dogs

- > 400 genetic diseases are known in dogs
- > 50% of these have a breed specific occurrence or are more common in certain breeds
- Inheritance is known for ~ 200 (55%)
- Breeding restrictions will depend on:
  - How serious the disease is for the dog
  - ....and for the breed
  - The general health of the breed

***–Only clinically healthy individuals should be considered for breeding!***



# The breed standard

- Norway and the Nordic countries have been working for soundness and functional health in the breed standards
- The following sentence is implemented in every FCI breed standard:  
”Any dog clearly showing physical or behavioural abnormalities shall be disqualified”
- Do the judges follow this?





# Screening tests

- Testing of a large number of individuals irrespective of symptoms
- May give useful information about the blood line or breed
- Selection on individual level?
- How does the result correlate to the breeding value of the individual?
- Status of offspring?
- Index based breeding



# Breeding restrictions

## *Objective parameters:*

- DNA Tests
- Other screening results (eg HD, ED, patellar luxation)
- Central registration in registry with public access
- How strict should breeding restrictions be --?



# What may be the consequences of too strict restrictions?

- Too strong focus on single diseases – the ones that are easily diagnosed and registered by the national kennel club?
- Reduced genetic variation – difficult to select for other traits than the ones in focus
- Problems in the long run -?



# Heavy restrictions?

- Remove the breeders' responsibility?
- Increased tendency towards lower numbers of sires per generation, and subsequently reduced genetic variation
- Increasing tendency towards breeding outside the the national kennel club system – these breeders are no longer within reach for information, seminars, cooperation
- Reduced information regarding diseases, breeding, blood lines



## Rule #1:

**The total breeding restrictions should not exclude more than 50% of the breed population**



# ”Popular Sire Syndrome”

An individual dog (most commonly a sire) with too many offspring  
- reduced genetic variation



**Rule #2:**  
**No individual dog**  
**should have more offspring during its lifetime**  
**than**  
**5% of**  
**a five year period registration number**  
**for the breed**



# ”Bottleneck”

- A *bottleneck* is a marked reduction in genetic diversity
- In many cases the cause is a rapid reduction in number of individuals
- A functional bottleneck may occur because of «popular sire syndrome»
- A bottleneck effect may be strong in small populations
- Note! A bottleneck is more or less irriverisible!





# Challenges

- Inherited diseases - numerous
- Breed type – conformational and behavioural traits may compromise individual welfare and function if too extreme (*Pedigree dogs exposed*)
- Too little focus on mental traits? Difficult to measure?
- Low genetic diversity
  - Previous «bottleneck»?



Image: Ingrid Hemming

# The balance between genetic diversity and heavy selection



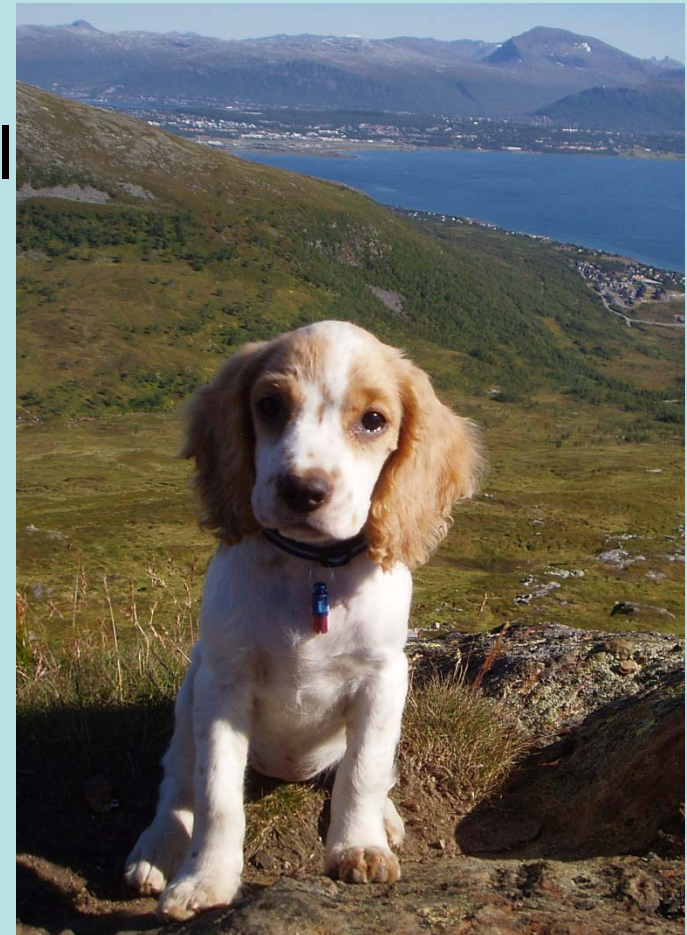
- We must try to...
  - Select for healthy dogs
  - To keep selection pressure at a level that ensures genetic diversity
- We would like to know...
  - The genetic component of all diseases
  - Inheritance of all inherited diseases
- Unfortunately, this is not the situation!



Image: Ingrid Hemming

# Total evaluation of the individual

- Health?
  - Functional health; the individual must be functional and not suffer from conditions that appear as reduced function – this is a minimum!
- Mental constitution
- Bloodline
- Use this to make the right *combination* of individuals!



# The goal of modern dog breeding

Functionally healthy dogs,  
with mentality and  
physical conformation  
typical to the breed,  
that are able to live a  
long, healthy and  
happy life



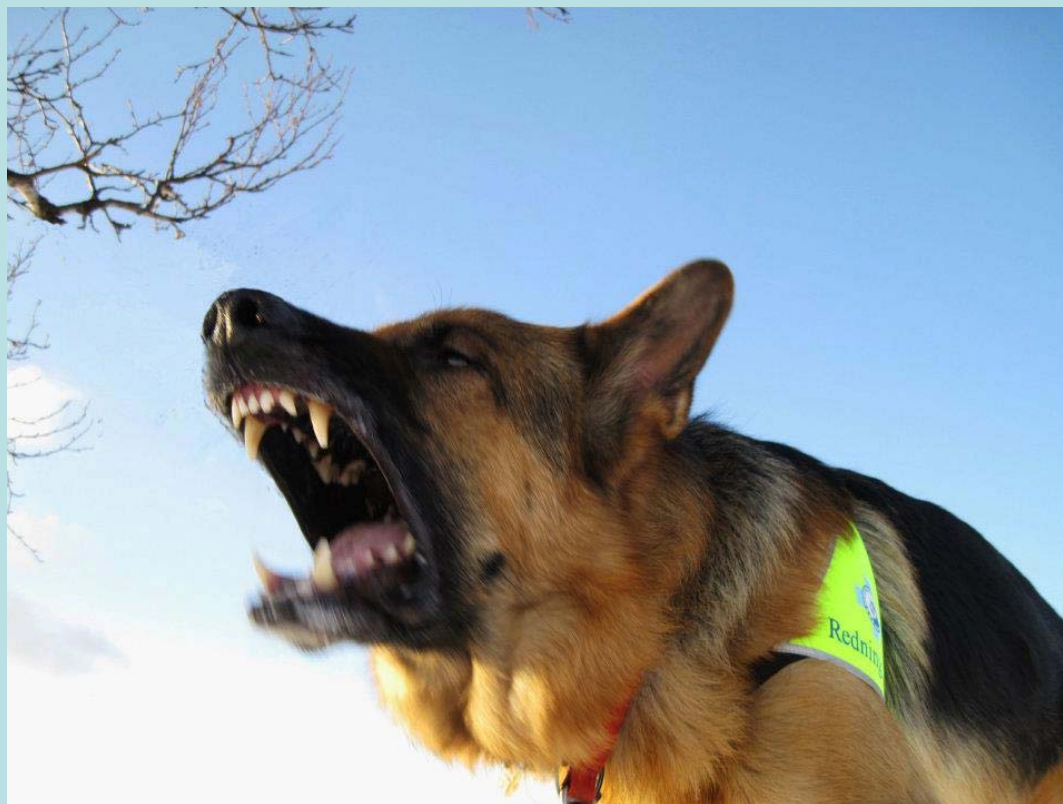
Image: ISIC

# Summary

- Knowledge – *gather knowledge about dogs and bloodlines and use it with common sense*
- Be honest about disease and possible negative traits
- Consider *functional health* when selecting animals for breeding
- Breeders have a great responsibility
- Total evaluation of the individual animal
- *The combination* of breeding animals is equally important!



# Loss of pm1



# Loss of the pm1

(data from K. Sainio, Finland)

- New data from Finland states that pm1 may be in place, rudimentary or missing
- It is not a problem for the dog (eating, welfare)
- Loss of pm1 is normal development in the dog as a species
- This is not an inherited trait (must be other factors?)
- Does not correlate with more severe dental loss



# Patellar luxation



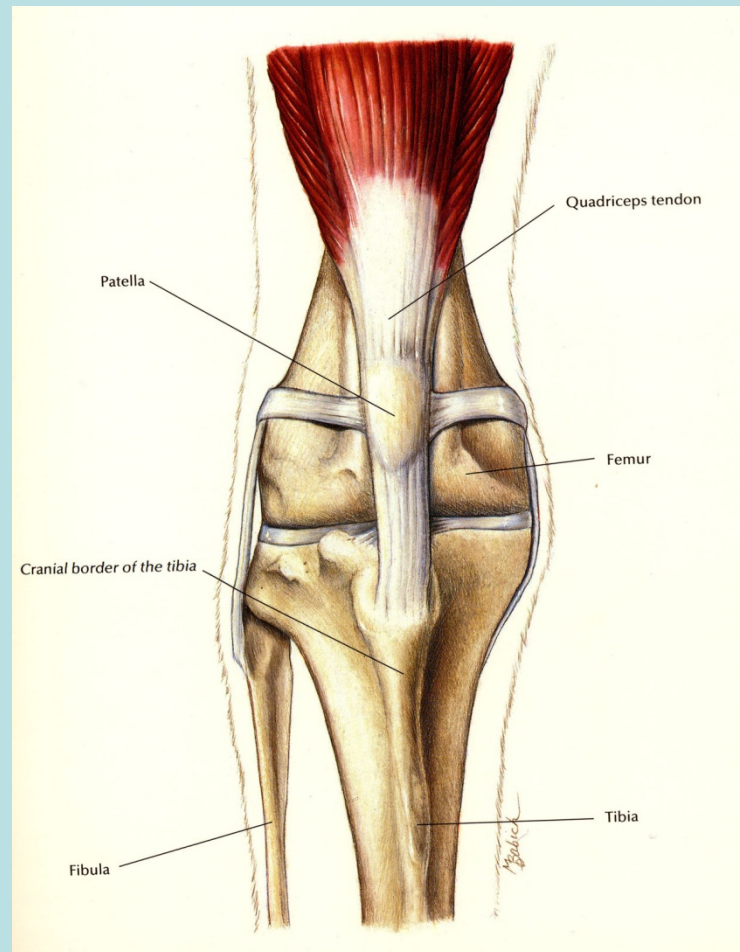


# What is patellar luxation?

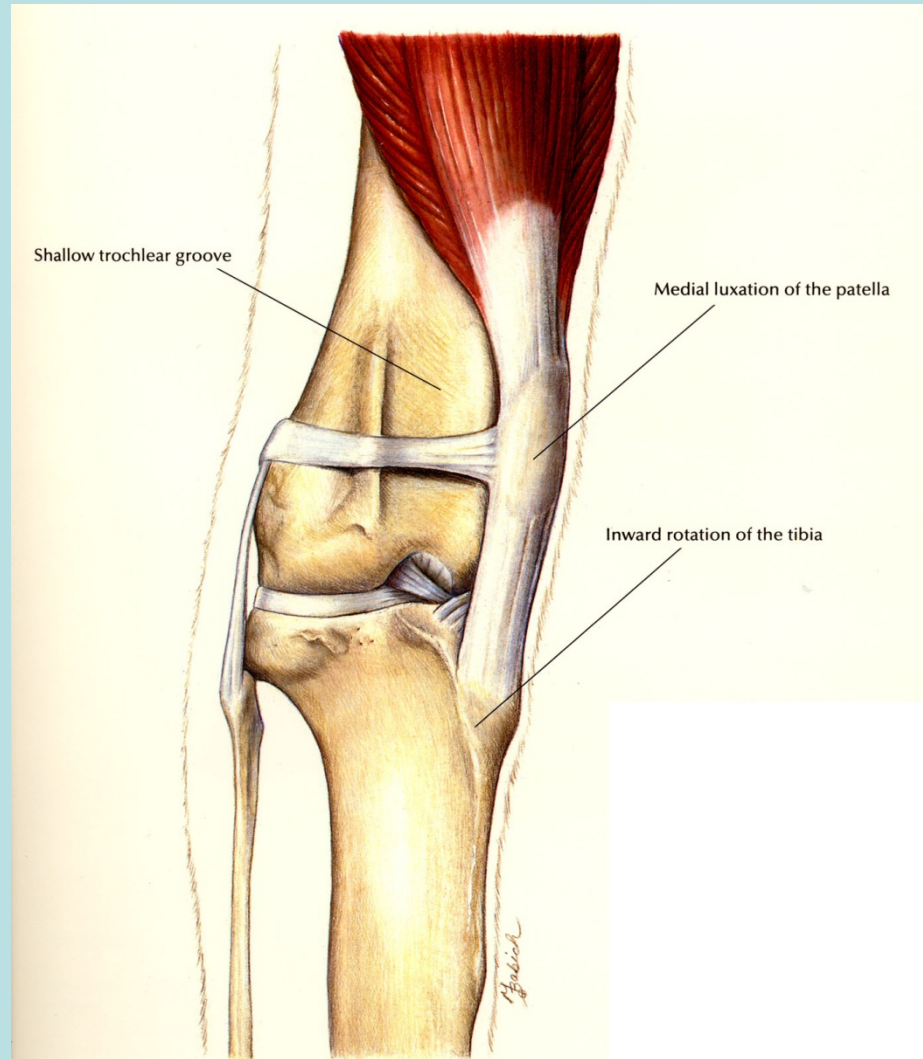
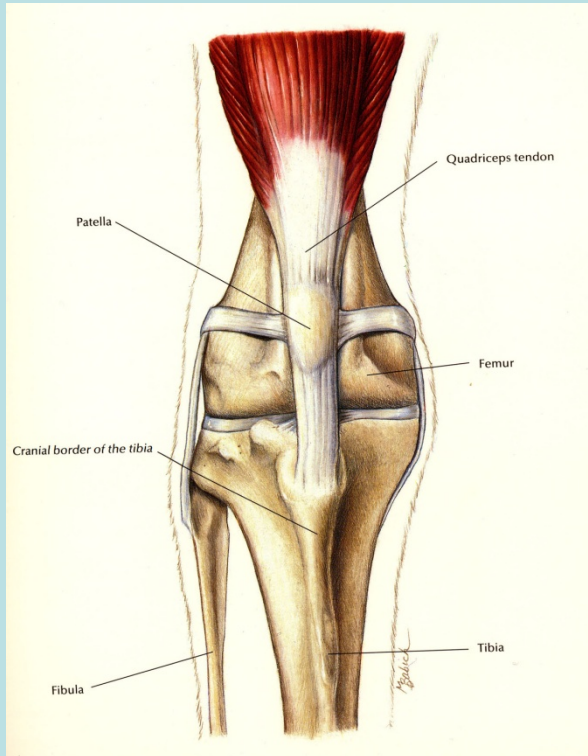
- Patella = the knee cap
- Luxation = "out of place"
- Alle dogs have **patella** (knee cap), but fortunately they do not all have **patellar luxation!**
- Patella is located outside the patellar groove (or may be luxated manually)
- May luxate laterally or medially

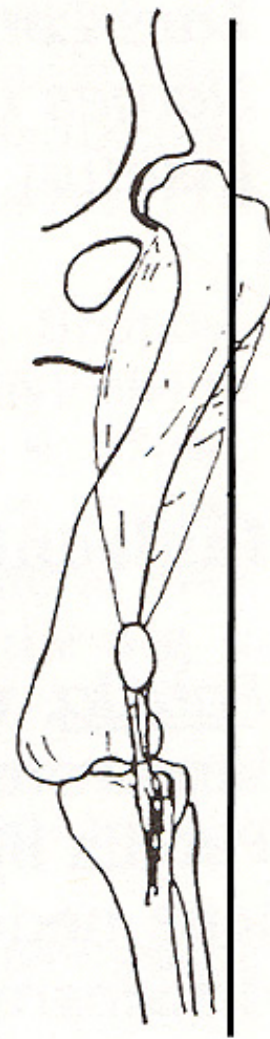
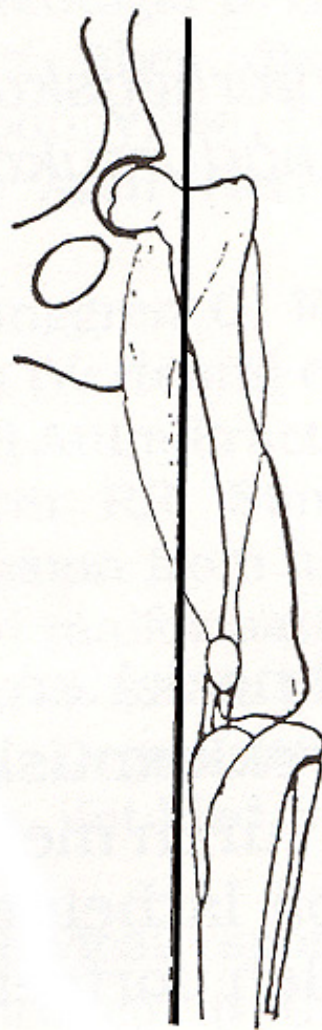
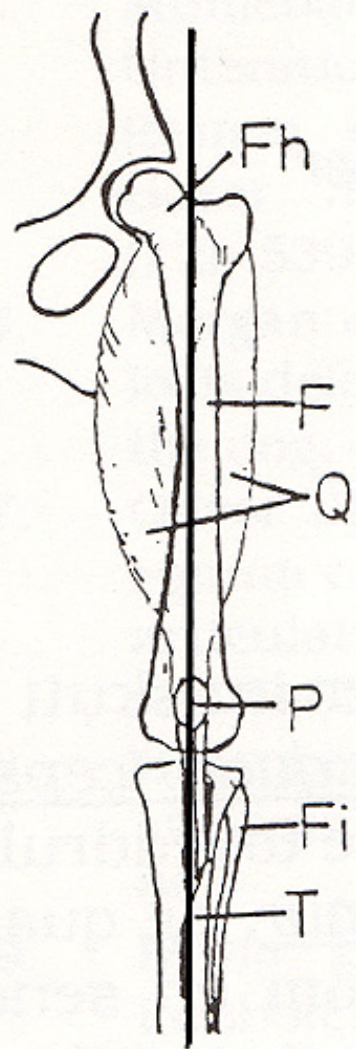


# The stifle (knee)



From Hill's Atlas of Veterinary Clinical Anatomy <sup>34</sup>





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Lateralist U  
Us nr: 500261701231  
Visningspos. VD  
Studietype: NKK HD/AD  
Serietype: Pelvis\_VD  
(3-1 (ALLE))

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# Causes

- Inherited condition, but heritance is not known
- Usually conformational changes in the entire back leg – leading to luxation of the patella
- Rarely results from trauma (without predisposition)
- Trauma *may* make the patella luxate in a dog with predisposing factors in its back legs



# Symptomes

- Usually in young dogs
- Limping
  - Very variable
  - Typical: "jumping" where one leg is lifted – back to normal gait in a few steps
- Most frequently affects both legs



# Treatment

- physical exercise
- Surgery if there is a clinical problem
- Gentle reconvalescence and regain of muscles
- Planned exercise and optimal body condition
  
- Prognosis depends on
  - Underlying conformational anomalies in the back legs (the cause of the luxation)
  - Degree of luxation
  - Surgical technique
  - Secondary changes in the stifle
  - Breed – size – conformation





# Registration of patellar luxation

- NKK: Central registration in DogWeb will be available during 2013(?)
- New guidelines for evaluation (equal to SKK):
  - Grade 0 normal
  - Grade 1 mild
  - Grade 2 moderte
  - Grade 3 severe



# Breeding restrictions?

- How common is the problem?
- How severe is the problem?
- The individual should be functionally healthy
- Consider the patellar luxation status as a combination tool
- If you breed from an individual with patellar luxation – select a breeding partner with best possible patellar status<sub>42</sub>



Merethe and  
Buska during  
avalanche  
training in  
Hummelfjell,  
Norway 2012



*Thank you for your  
attention!*

