# Monogenetic traits in Jerseys



EJF Monogenetic Working Group
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# Few genetic defects

- All Jerseys origin from Jersey Island
- Inbreeding in Jerseys is very old, - and old inbreeding is positive:
  - Very homogene world population
  - Less risk of developing defects
- New inbreeding can have negative effects
  - Make use of mating programs taking inbreeding into account!



# What is a monogenetic trait?

- A **characteristica** observed in an animal **that is controlled by a single gene**
- Also called Mendelian traits as they follow a Mendelian inheritance pattern
- E.g. coat colour, dwarfism, double muscling, malformations, severe health disturbances

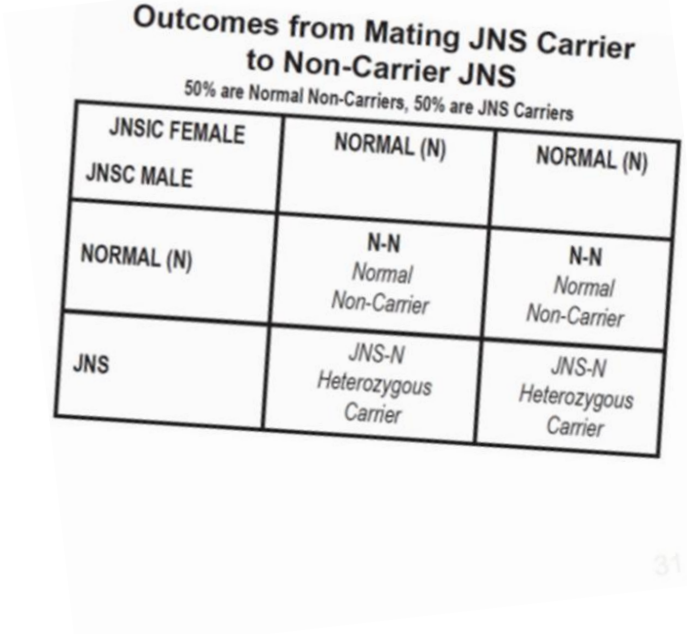
- Alleles determining expressions may be:
  - **Dominant** (Polledness; PP and Pp gives polledness)
  - **Recessive** (Red coat colour; The allele for Red coat colour is bb or ee)

# Trait characteristics

- Some characteristics of monogenetic traits are **desirable**, ex. polledness, β-casein (A2A2),κ-casein (BB for cheese making)
- Many are **undesirable**: genetic defects of which most are recessive
- Some have neutral effects, e.g. red factor (recessive or dominant and gives red coat color)
- Different traits characteristics arise naturally through mutations

# Monogenetic traits (undesirable)

- Recessive Haplotypes / Genetic defects
  - JH1
    - Effects on fertility (no pregnancy or early abortion)
    - Economic important
  - JH2
    - Little effect on fertility
    - Not considered of economic importance
  - JNS
    - Weak fore legs and spasms in newborn (not able to live)
    - Economic important
  - Yellow fat
    - An enzyme playing a key role in carotenoid metabolism
    - Mutations can lead to accumulation of carotenoids in fat tissue (yellow fat)
  - JJM
    - Jersey Juvenile Mortality
    - Weak immune system, Anemia, Cancer …



# JJM - Jersey Juvenile Mortality

- New mutation (recessive lethal) discovered in France
  - 170,000 genotyped animals have been checked
    - 22,800 carriers, as it seems that the mutation started more than 10 years ago.
  - The know and most used carriers are:
    - VJ Quintana, VJ Hamlet, VJ James, VJ Huus, VJ Last, VJ Hamulus, VJ Google, VJ Bang, VJ Hempel, VJ Husum, VJ Grizly, VJ Rockit, VJ Herbie, VJ Nobu, VJ Niov P and VJ Heldis P.
  - No current top bulls are carriers
  - The university is trying to find the origin and make a full description of how widespread JJM is. They will also register the name, before they are ready to produce a press release and inform all in the AI industry.
  - We expect that JJM will be included in the official genomic test result, on both females and bulls within the next months.
  - Mating carriers when breeding bulls and bull mothers is avoided from now on.

# Monogenetic traits (desirable)

- Pollednes
  - Genetic hornless animals desired, of the following reasons:
    - Ethics, labour, costs …
  - Aim is to increase ratio of homozygous polled bulls (PP), to stop de-horning
- Caseins/Proteins
  - Cappa Casein
    - Animals with the B allele are desired
    - Effects on cheese yield and the speed of cheese making
  - Beta Casein
    - Animals with the A2 allele are desired
    - Effects on human health
  - Beta Lactoglobulin
    - The major whey protein (app. 65%)
    - Effects on transporting iron into immune cells
  - D-GAT
    - Effects on especially Fat% and Milk yield



# D-GAT

- DGAT1 is short for **DiacylGlycerol o-AcylTransferase 1**, an enzyme that catalyses the final step in triglyceride synthesis in the mammary gland. This gene plays a major role in determining **milk fat content** and influences overall milk composition.

**•K (or G) allele (Lysine)**
- **•Higher fat %** in milk
- •Slightly higher protein %
- **•Lower milk yield**

**•A allele (Alanine)**
- **•Higher milk yield**
- •Lower fat %
- •Protein % tends to decrease slightly with A allele

# Handling monogenetic traits

- Full declaration on all breeding animals, from genomic test
- **Monogenetic traits can be handled by different strategies:**
  - Elimination strategy I:
    - No carriers accepted – allele frequency halved for each generation of bulls
  - Elimination strategy II (partly):
    - Some carriers can be accepted if breeding values are high enough
  - Acceptance strategy:
    - Carriers are accepted

# Next steps for the EJF Monogenetic Working group

- Register & describe **new traits** of economic interest
- **Register and publish the ratio** of preferred alleles in European Jersey populations
- Recommend **genomic testing** to get genotypes of the animals
- Take **monogenetic traits** into account **in Breeding programs**
- Follow the development




Thank you for your attention!