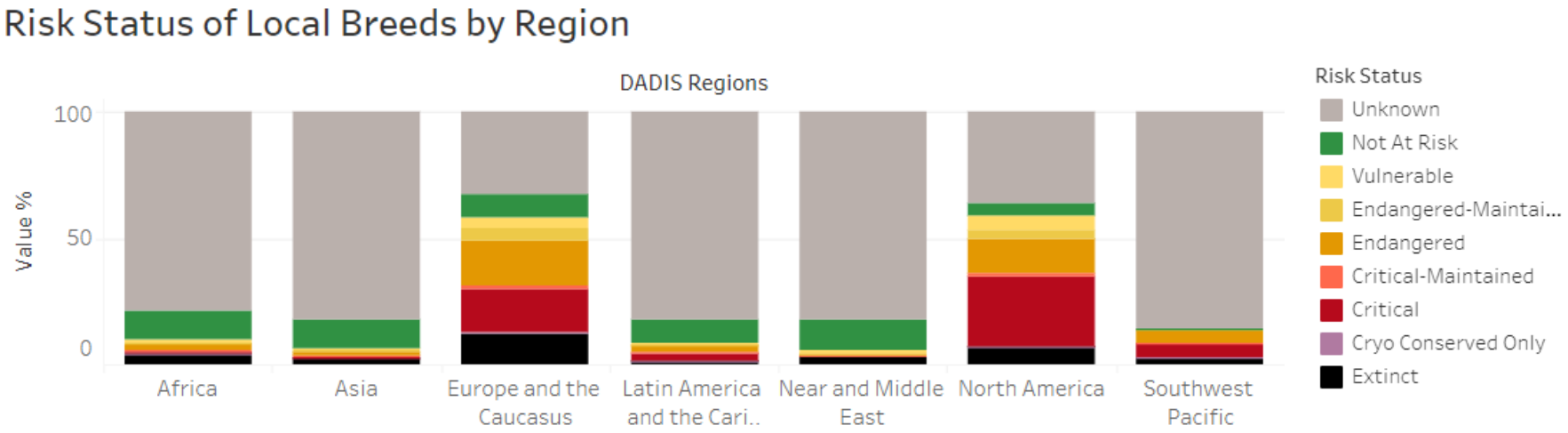
Beyond sperm

Next steps for the development of CGN livestock gene bank

March 15th 2023 – Annemieke Rattink and Julie Lamy

WAGENINGEN
UNIVERSITY & RESEARCH

Why is a gene bank needed? (1)



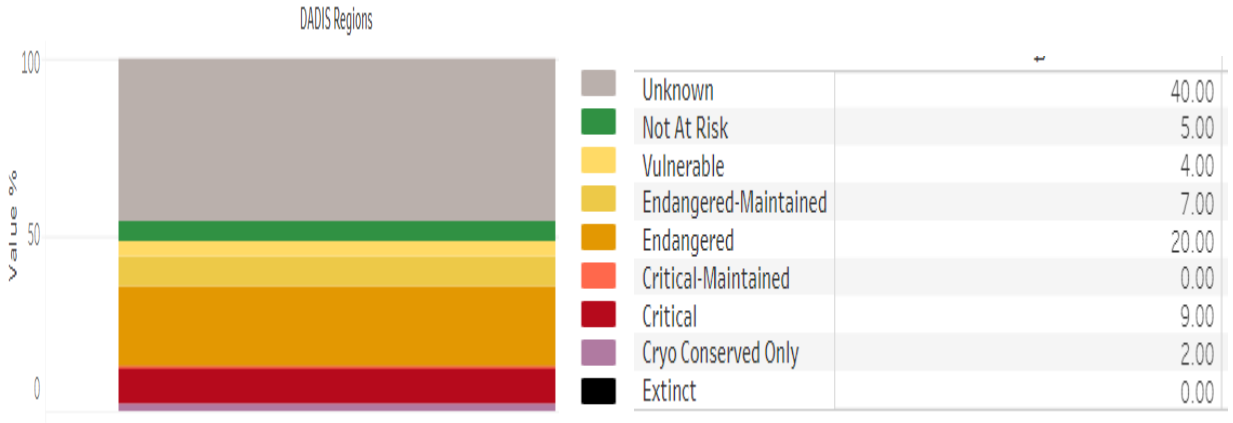
- 2/3 of known local breeds at risk

Food and Agriculture Organization of the United Nations

WAGENINGEN UNIVERSITY & RESEARCH

Why is a gene bank needed? (2)

Risk status of Dutch breeds



Animal genetic resources (livestock breeds)

- Maintenance and further development of genebank collections

- Advising breed societies and breeding organisations
    - Sustainable breeding programs

- Genebank database and genomic database

- European collaborations

ERFP EUGENA

WAGENINGEN
UNIVERSITY & RESEARCH

Aim of Dutch AnGR genebank *(ex situ)*

Long term

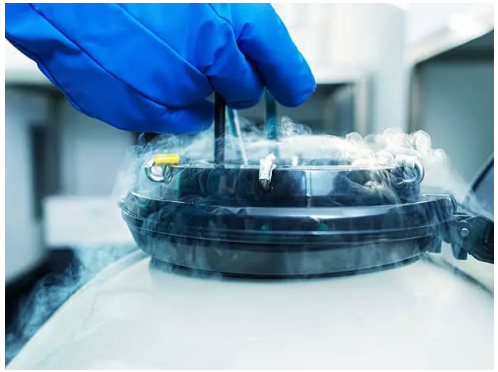
- To safeguard all rare/native/endangered breeds of farm animals in the gene bank
- To promote and facilitate conservation of back-up samples of all (commercial) breeds in the gene bank

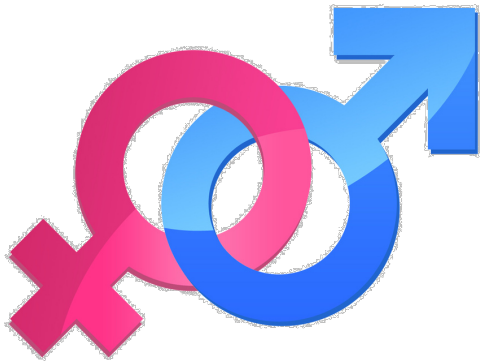
Short term

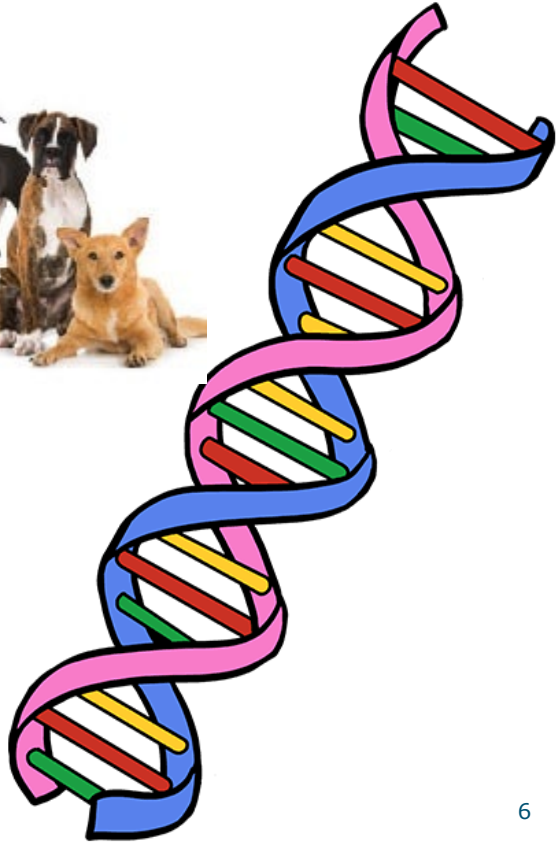
- To support breeding programs of endangered breeds - by distribution of gene bank semen

What do we do? - Research

- Population genetics
- Genomics and breeding
- Cryobiology
- Reproduction







WAGENINGEN
UNIVERSITY & RESEARCH

How do we collect samples? – Semen

Communication with breeders → Collecting semen → Freezing and storing

Commercial or local rare breeds

In vivo collection

Post-mortem collection

Current collection - Semen

Species	Breeds	Donors	Doses	Birth years donors
	26	6,682	269,811	
	12	364	34,672	
	36	802	22,614	
	31	270	18,652	
	6	100	7,037	
	15	148	5,449	
	8	62	1,889	
	4	67	1,569	
	7	20	257	
	1	11	102	
	146	8,526	362,052	1959 ---------- 2022

Status July 2022

Annual targeted growth:

- 2% targeted growth in number of donor animals per year

Approaches to expand collection:

- Regular back up
- Offers from individual breeders and breeding organisations
- Targeted collection of genetic material

Prioritization of activities and decisions what to add

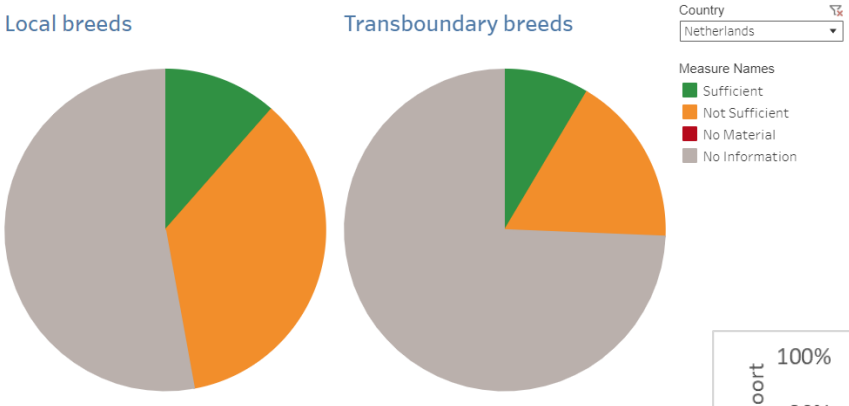
Current collection - Embryos

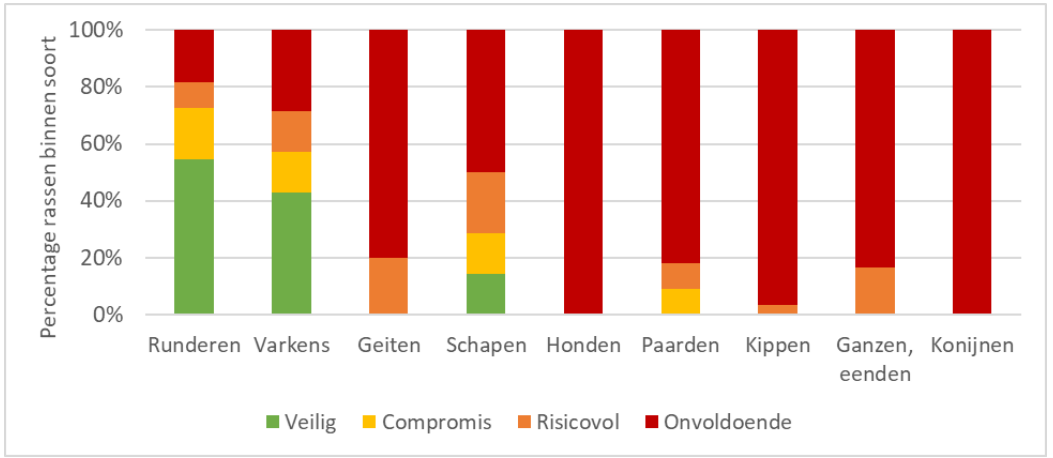
Cattle:

Brandrood – 15

Fries Roodbont - 42

Is material sufficient for reconstruction breed?





Beyond sperm....

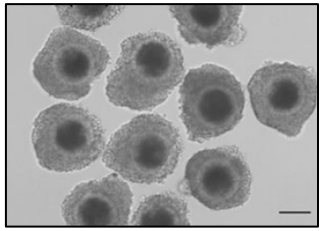
Somatic cells

Hairs

Blood

Reproductive cells

Oocytes



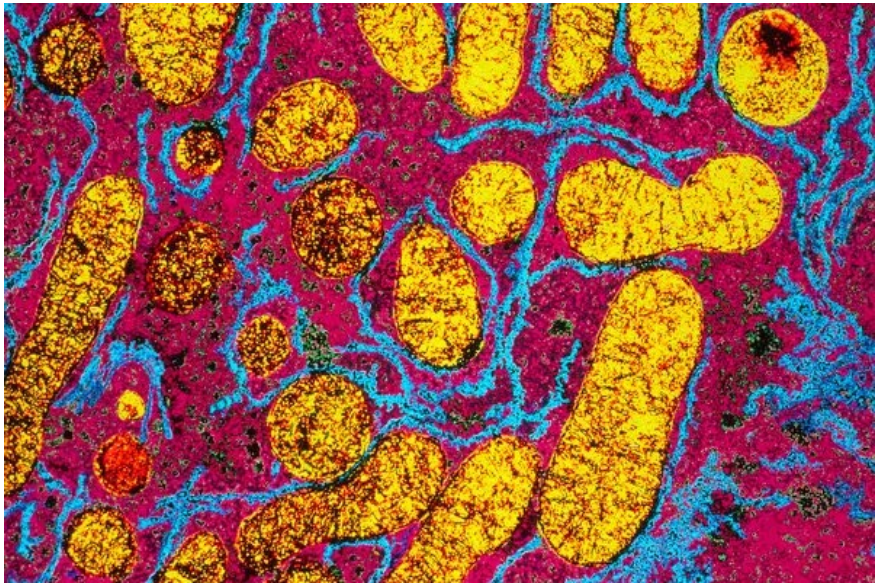
Ovarian tissue

Embryos

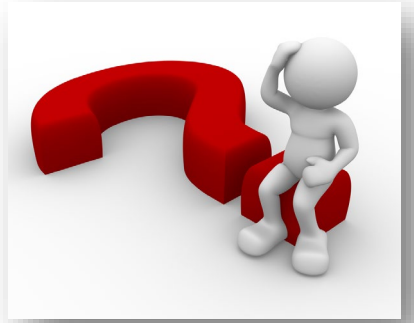
Primordial germ cells

Why female germplasm?

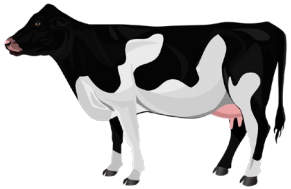
- Preserve maternal genome or combination of male and female
- Maternal inheritance (imprinting, heterosis)
- Mitochondrial DNA preservation
- Different selection in female lines
- No back crossing



How to use female germplasm?



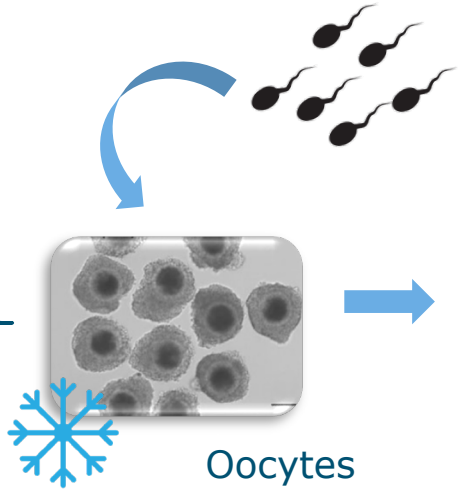
In vivo



Ovum pick-up (OPU)

Ex vivo

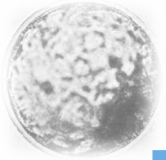
Ovaries



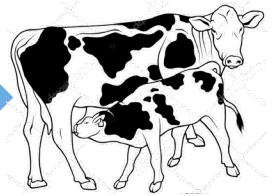
Oocytes

In vitro fertilization

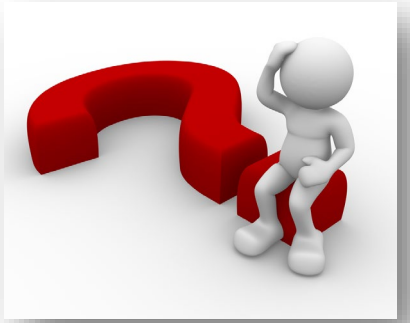
Embryos

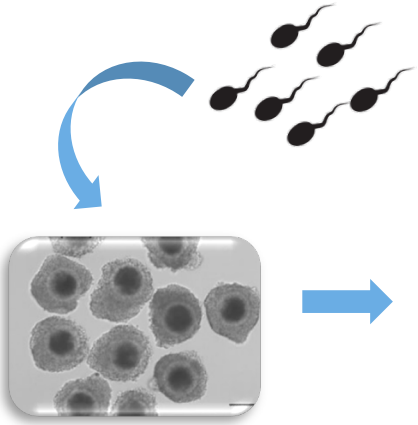


Transfer



How to use female germplasm?



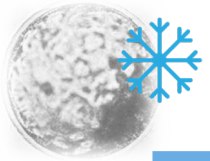


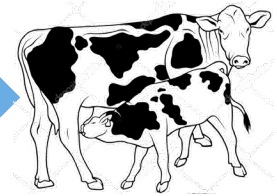
In vitro fertilization

Oocytes

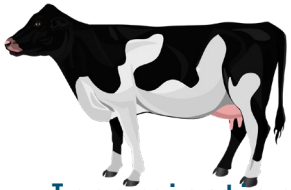
Embryos

Transfer





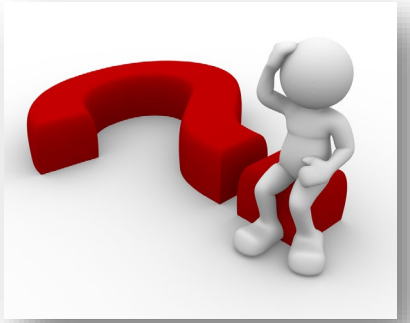
In vivo



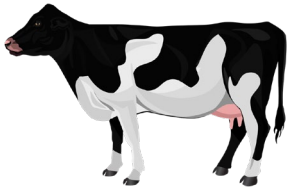
Insemination

Uterine flushing

How to use female germplasm?

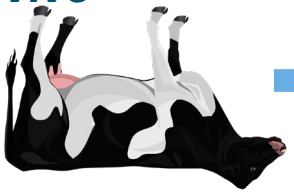


In vivo

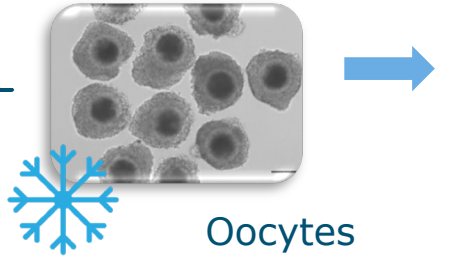


Ovum pick-up (OPU)

Ex vivo



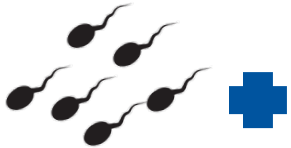
Ovaries

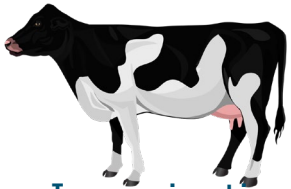


Oocytes

In vitro fertilization

In vivo

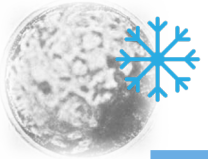




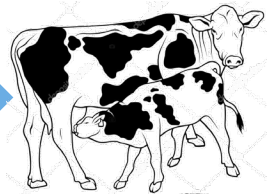
Insemination

Uterine flushing

Embryos

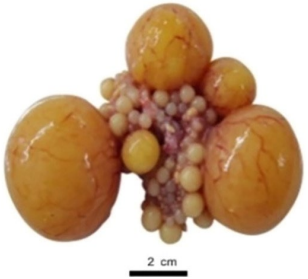


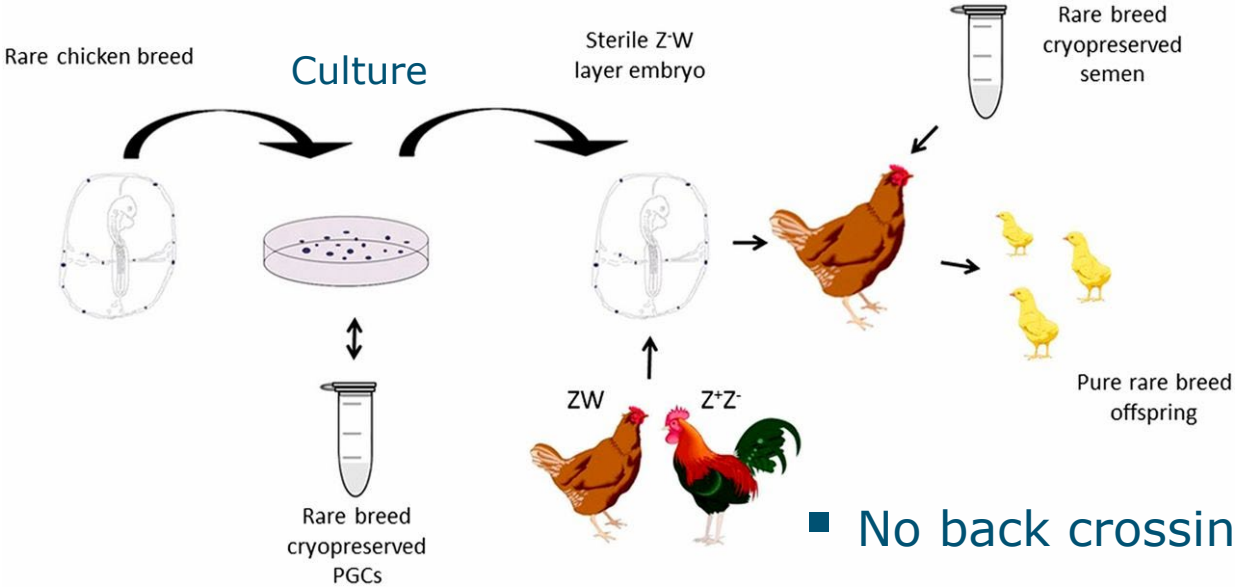
Transfer



Why Primordial germ cells?

- Precursor of gonads
- Species where impossible to freeze oocytes or embryos





- No back crossing!

Beyond sperm....

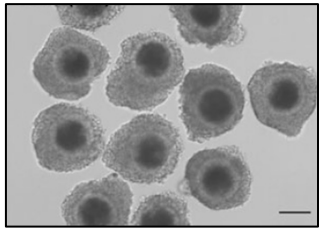
Somatic cells

Hairs

Blood

Reproductive cells

Oocytes



Ovarian tissue

Embryos

Primordial germ cells

Why somatic cells?

- Easy processing
- DNA sequencing, research
- Integrate information in breeding programs

Hairs

Blood

- Techniques currently not allowed

Beyond sperm....

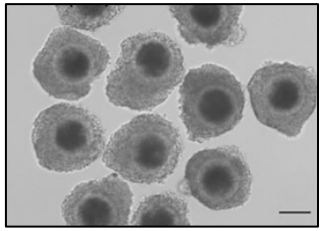
Somatic cells cells

Hairs

Blood

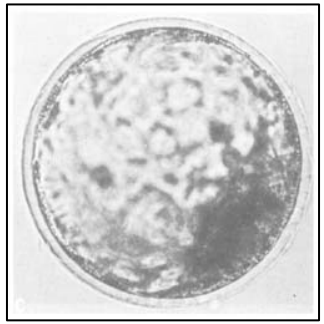
Reproductive cells

Oocytes



Ovarian tissue

Embryos

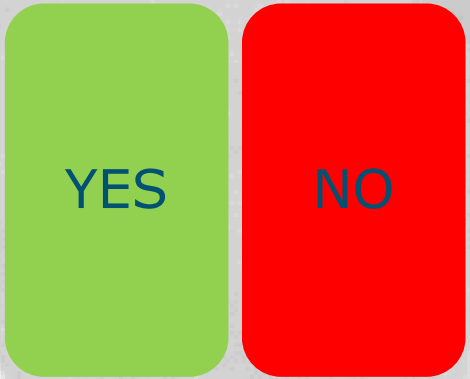


Primordial germ cells

Now…

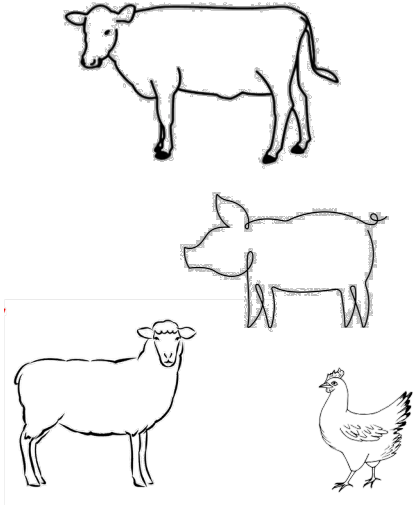
Time for questions and interaction!

Should we focus on other samples than sperm?



For those who said no....

What would be the main reason not to proceed?



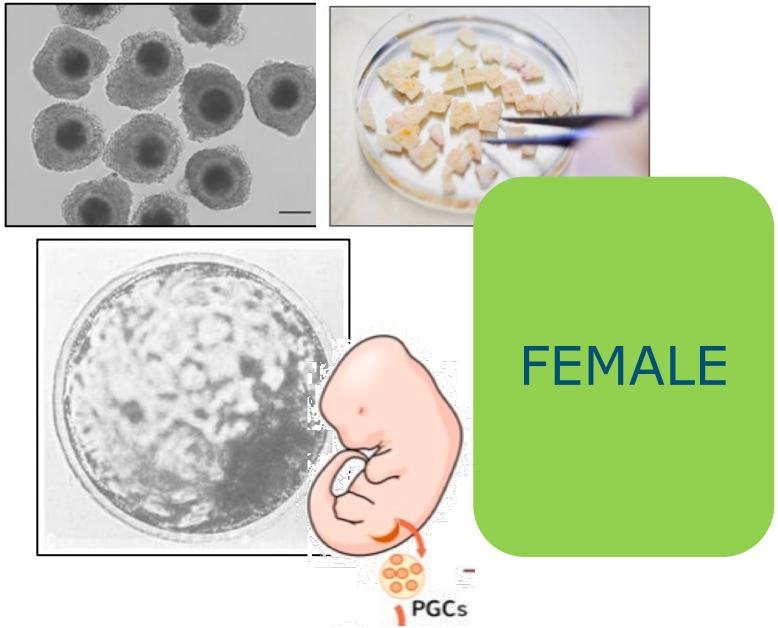
PRACTICTAL
LAB/FARM

LEGAL OR
FINANCIAL

WAGENINGEN
UNIVERSITY & RESEARCH

For those who said yes....

What should we focus on first?



FEMALE

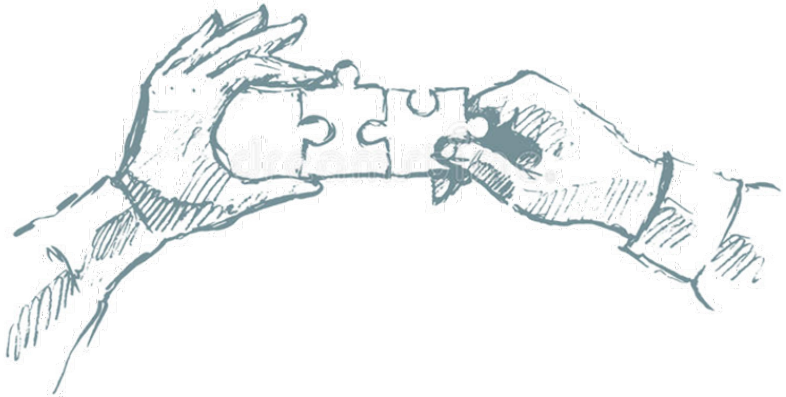
OTHER

What species should we start with?

What species should we avoid?

Would you be willing to collaborate or can you help with practical, financial or legal aspects?

YES

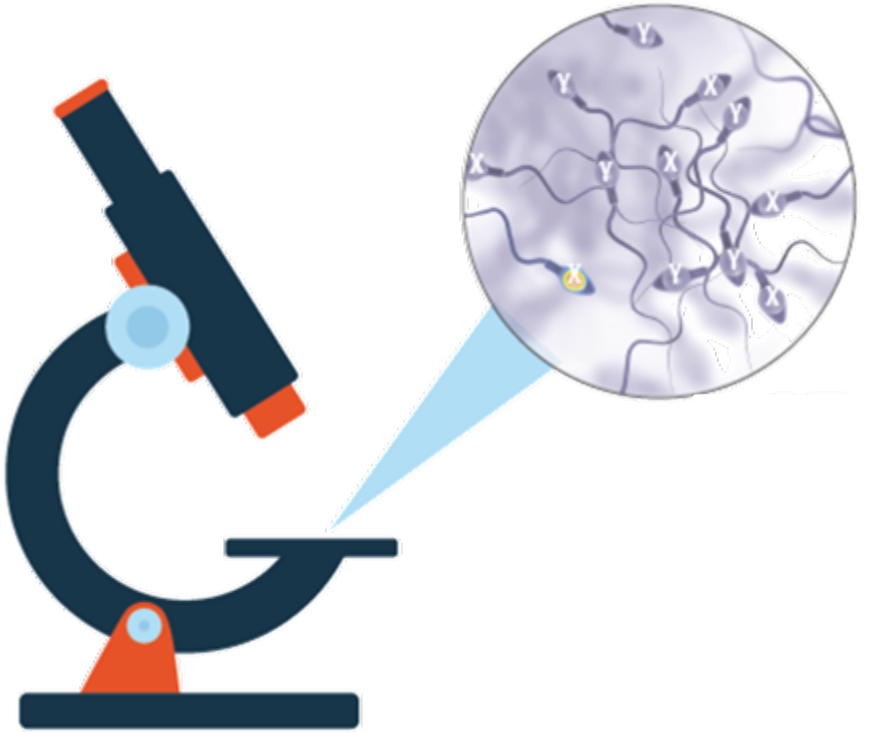


NO

Would sexed sperm be a good addition to the gene bank?

YES

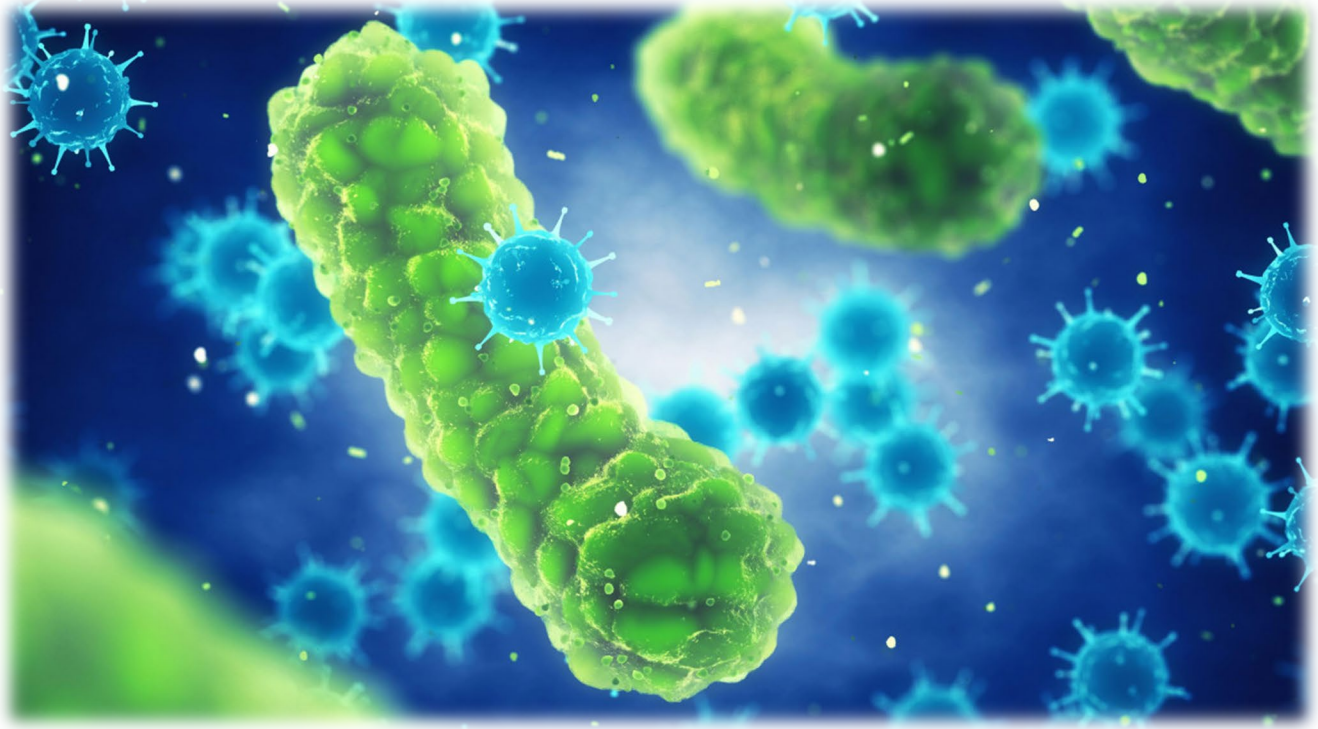
NO



What do you see as advantages to add hair/blood samples to the gene bank?

WAGENINGEN
UNIVERSITY & RESEARCH

What about microbiome samples?



WAGENINGEN
UNIVERSITY & RESEARCH