Animal breeding and ethical values

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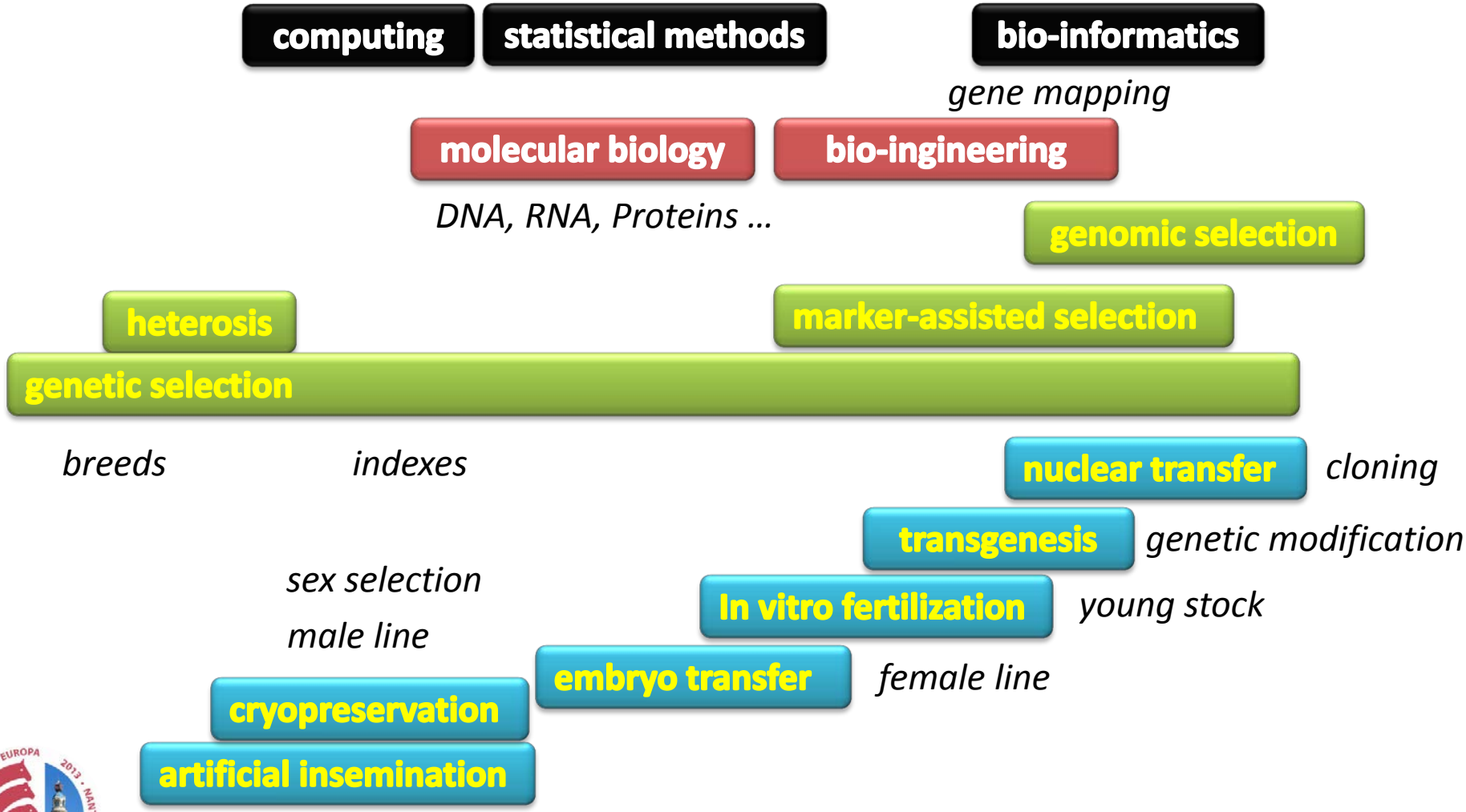
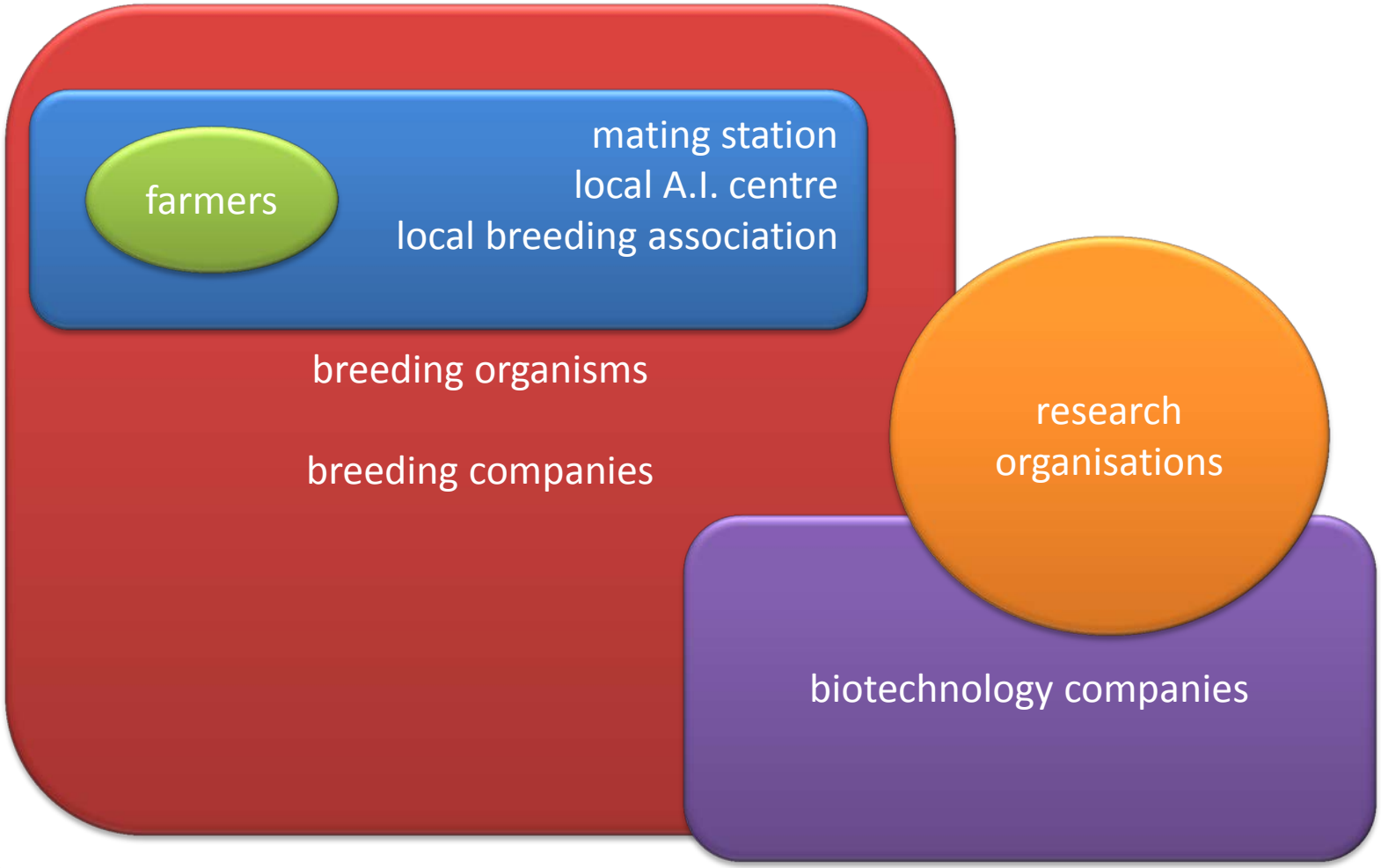
Breeding

Breeding implies actions on the genome of a population in order to keep it stable (homozygous lines, cloning) or to modify it (selection, crossbreeding), which can be combined with reproductive techniques such as A.I., E.T., I.V.F., transgenesis, cryopreservation, semen/embryo sexing

Breeding: timeline



Actors in breeding: from local to global

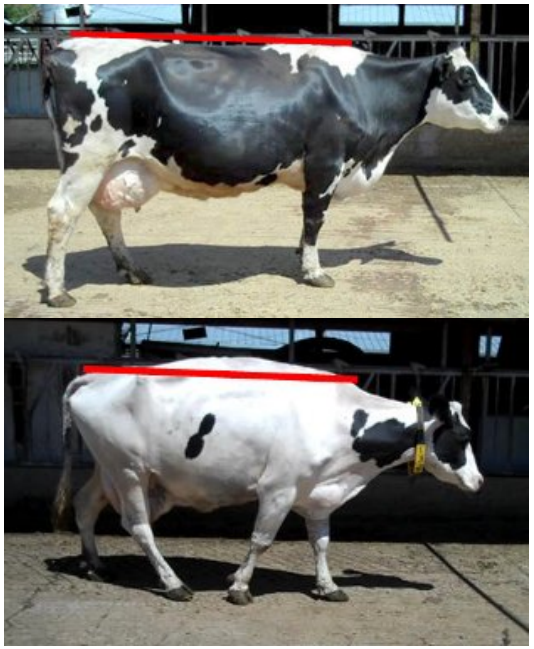


Cases and values

		W (Welfare)	A (Autonomy)	J (Justice)	IV (Intrinsic value)	I (Integrity)	N (Naturalness)	C (Caution)	Ae (Aesthetics)
Genetic selection	breeding goals, blind hens, featherless chicken, polled ruminants								
	artificial insemination								
	embryo transfer								
	in vitro fertilization								
Sex selection	calves, chicken								
Genomic selection	breeding goals								
Transgenesis	production animals (transgenic fish), transplantation, bio-pharmaceuticals								
Cloning	meat cattle competition horses								

Genetic selection and breeding goals

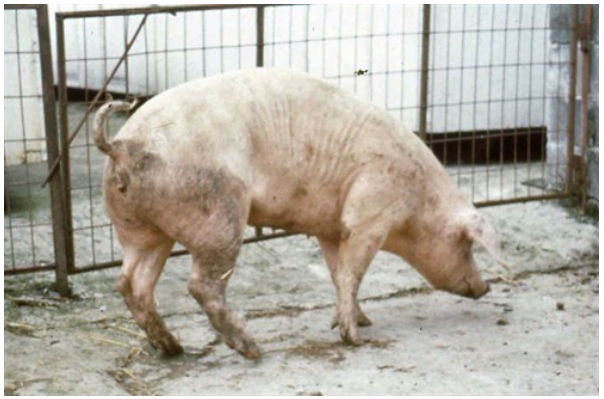
- Increase of productivity: negative effects on health and welfare



metabolic disorders, lameness, fertility

INRA Productions Animales, Février 2004

leg weakness



leg weakness, osteochondrosis

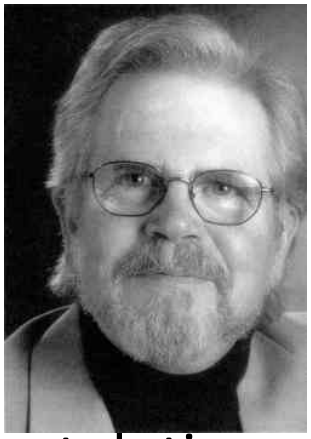
Sandoe (1996, 1999), Rauw (1998)
Allen (2001), Larrère (2003)
Olson (2004), Busch (2005),
Gamborg & Sandoe (2005)
Neeteson (2006), Star (2006)
Aerts (2006), McArthur Clark (2006)
Decuypere (2010), Nielsen (2011)

welfare, autonomy, justice

Genetic selection and breeding goals

- Increase of productivity: major alterations
  - Behaviour — Jones (1999), D'Eath (2010)
  - Blind hens — Gjerris & Sandoe (2006)
  - Featherless chickens — Fraser (2001), Wells (2012)
  - Polled cattle — Gottards (2011), King-Eveillard (2013)

Intrinsic value



- **T. Regan** (1983):
  - Animals have beliefs, desires, perceptions which make them ends-in-themselves.
  - They have direct rights, and human have direct duties towards their well being
- **P. Taylor** (*Respect for nature*, 1986):
  - Animals and living beings have inherent worth (their life)
  - for this they matter morally
- **Animal Health & Welfare Act (NL, 1992)**

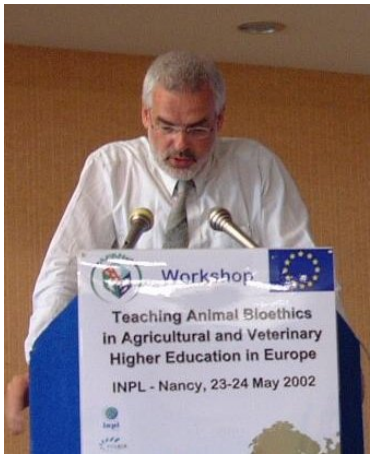
  "Any right accorded by or pursuant to this Act shall be exercised in recognition of the ***intrinsic value*** of animal life"

Integrity as a value

- Animal **integrity**: « the wholeness of the animal and the species-specific balance of the creature, as well as the animal's capacity to maintain itself independently in an environment suitable to the species »

B. Rutgers (1999)

Christiansen (200O), Bovenkerk (2002)



Naturalness as a value

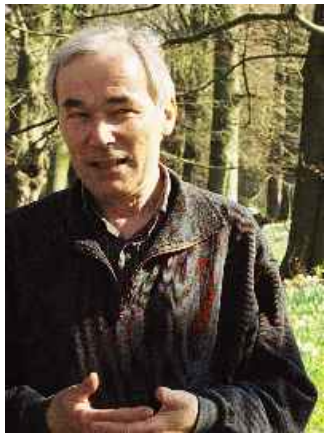
The value of naturalness refers to a basic respect for the intrinsic value of nature, i.e., the value *nature* has, independent of the benefits it may have for humans.

This manifests itself in three ways:

(1) in the use of natural substances,

(2) in respecting the self-regulation of living organisms and ecosystems

(3) in respecting the characteristic (species-specific) nature of living organisms.



H. Verhoog, E.T. Lammerts Van Bueren, M. Matze and T. Baars (2007), NJAS wageningen journal of life sciences, 54, 333-345.

Macnaghten (2004)

Cases and values

		W (Welfare)	A (Autonomy)	J (Justice)	IV (Intrinsic value)	I (Integrity)	N (Naturalness)	C (Caution)	Ae (Aesthetics)
Genetic selection	breeding goals,	✘	✘	✘				✘	
	blind hens, featherless chicken, polled ruminants	✘	✘	✘	✘	✘	✘		✘

		Well-Being	Autonomy	Justice
Cows	H			Equity of conditions of life
	D	Welfare	Freedom of behaviour	
	P			
Farmers	H	Income, Working conditions, Risks		
	D		Freedom of action	Commercial equity
	P			
Society	H	Security, Quality of life		
	D		Informed choice	Affordability
	P			
Environment	H			
	D	Conservation	Biodiversity	Sustainability
	P			

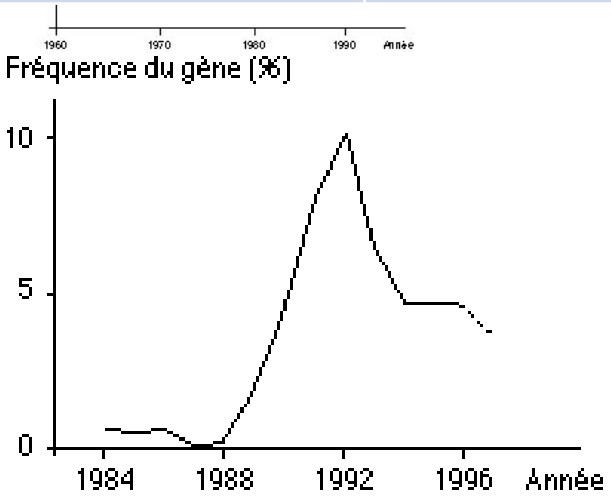
Horned	Well-Being	Autonomy	Justice
Cow			
Farmer			
Society			
Environmt			

Deprived	Well-Being	Autonomy	Justice
Cow			
Farmer			
Society			
Environmt			

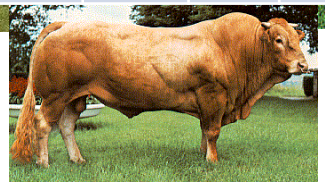
Polled	Well-Being	Autonomy	Justice
Cow			
Farmer			
Society			
Environmt			

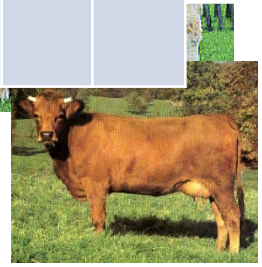
Genetic selection through A.I.

		W	A	J	IV	I	N	C	Ae
		Welfare	Autonomy	Justice	Intrinsic value	Integrity	Naturalness	Caution	Aesthetics
Genetic selection	artificial insemination	✘	✘	✘				✘	



Bovine Leucocyte Adhesion Deficiency gene



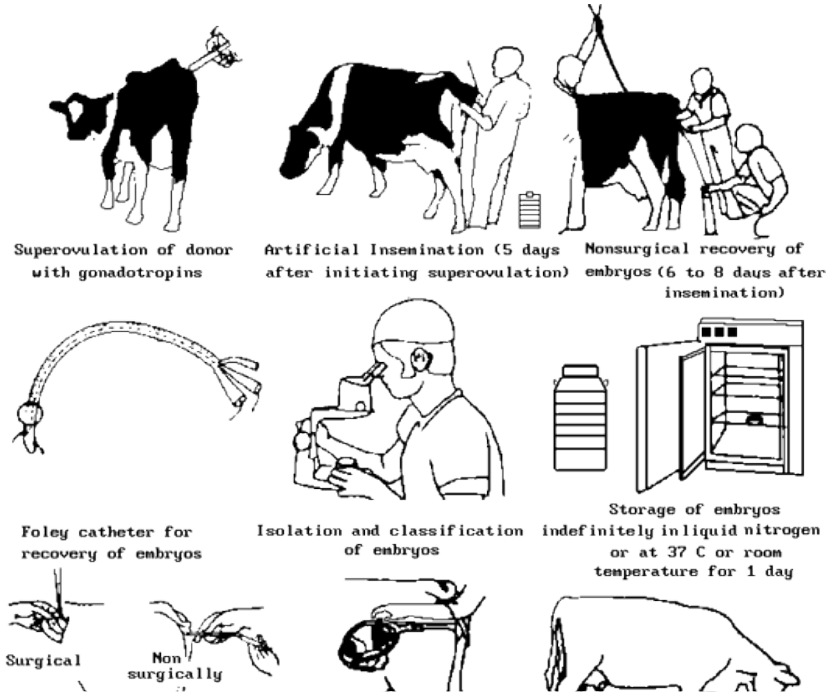


Biodiversity (intra-breed, inter-breed)
Health risks

Olson (2004)
McArthur (2006)
Boonen (2009)

Genetic selection through Embryo Transfer

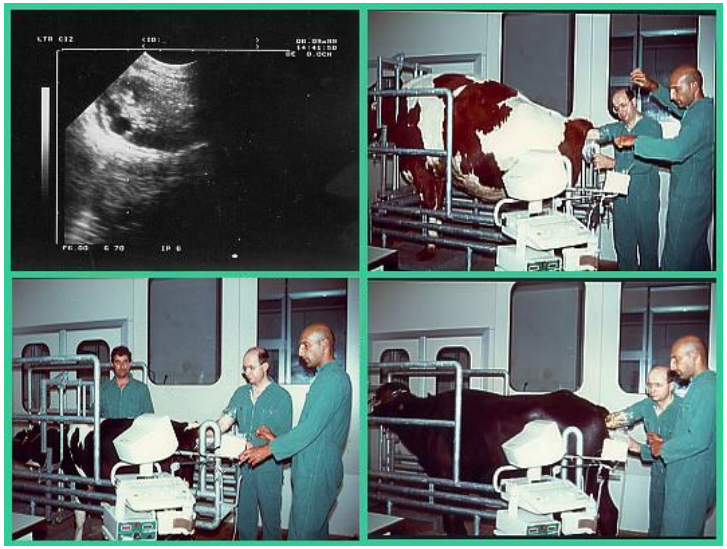
- Positive:
  - Better genetic improvement
  - Access to the embryo
  - Genetic heritage conservation
  - International exchanges
- Negative:
  - Welfare issues (surgical method in some species)
  - Hormonal treatments
  - Unnaturalness (organic production)



		W	A	J	IV	I	N	C	Ae
Genetic selection	embryo transfer	✘	✘	✘		✘	✘		

Genetic selection through I.V.F.

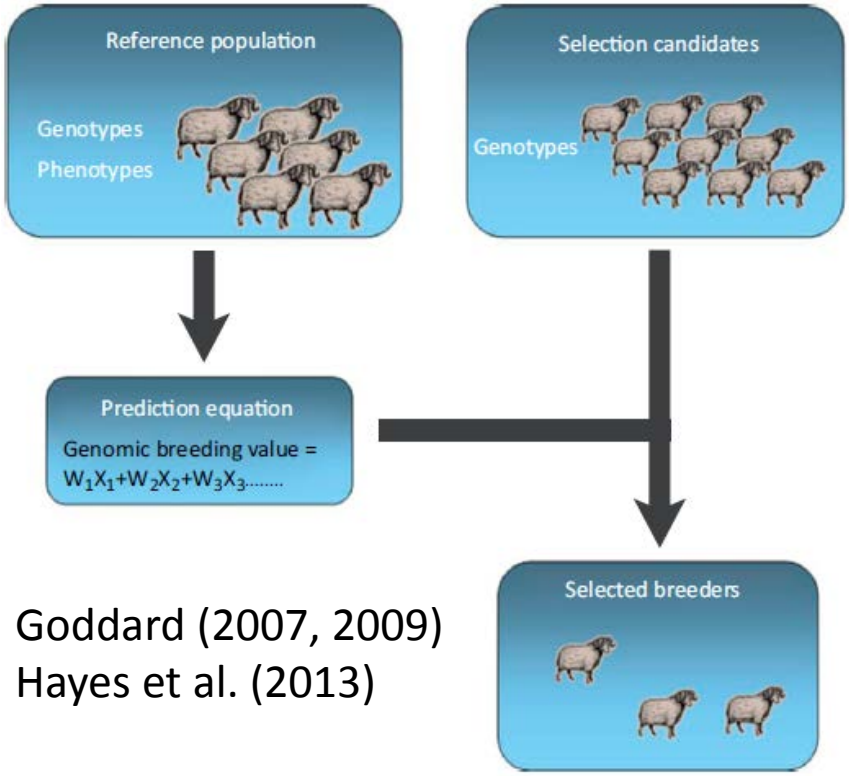
- Steps
  - Ovum pick-up
  - Maturation, fertilization, culture, transplantation
- Drawbacks
  - Success rate: 4% of oocytes to birth
  - High offspring weight (big calf syndrome)



		W	A	J	IV	I	N	C	Ae
		Welfare	Autonomy	Justice	Intrinsic value	Integrity	Naturalness	Caution	Aesthetics
Genetic selection	in vitro fertilization	✘	✘	✘		✘	✘		

Genomic selection

- Breeding goals ?
  - **Production–related traits**
  - Meat quality
  - Functional food
  - Disease resistance
  - Environment-friendly animals

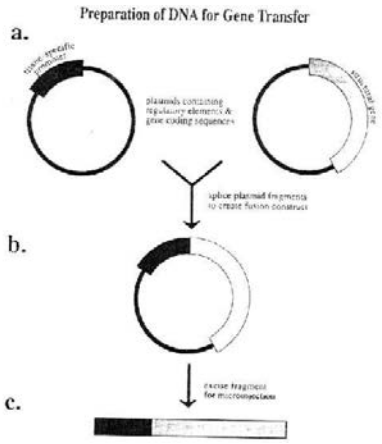


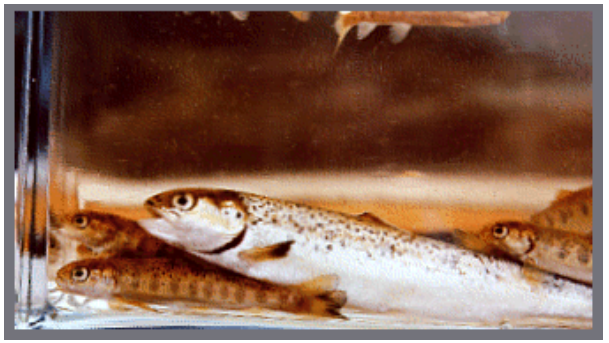
Goddard (2007, 2009)
Hayes et al. (2013)

Jacobs (2003)
Twine (2006)
Mark & Sandoe (2010)

		Welfare W	Autonomy A	Justice J	Intrinsic value IV	Integrity I	Naturalness N	Caution C	Aesthetics Ae
Genomic selection	breeding goals	✘	✘	✘		✘	✘	✘	

Genetic breeding through transgenesis





Uses: (Frewer, 2013)

- Production efficiency
- Bio-pharmaceuticals
- Xenotransplantation

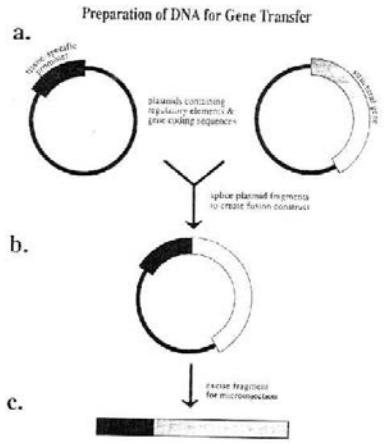
Low efficiency (Eyestone, cattle, 1999)

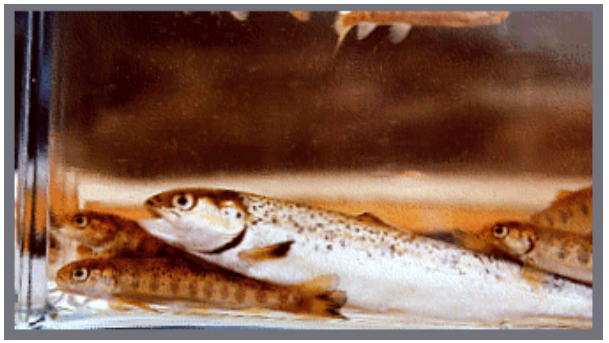
- microinjection: 36500
- transfers: 1470 (= 4 %)
- births: 226 (15% = 0,60%)
- transgenic: 18 (8% = 0,05%)
- Transmission: 3 to 54 %

Issues:

- Animal welfare
- Environmental effects
- Autonomy
- Intrinsic value
- Integrity
- Naturalness

Genetic breeding through transgenesis

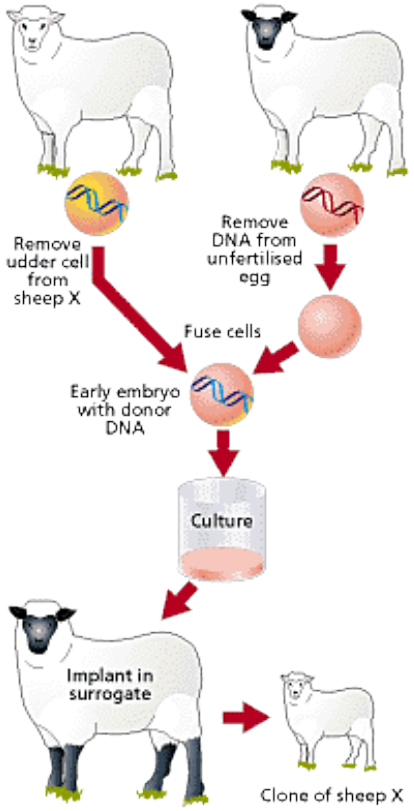


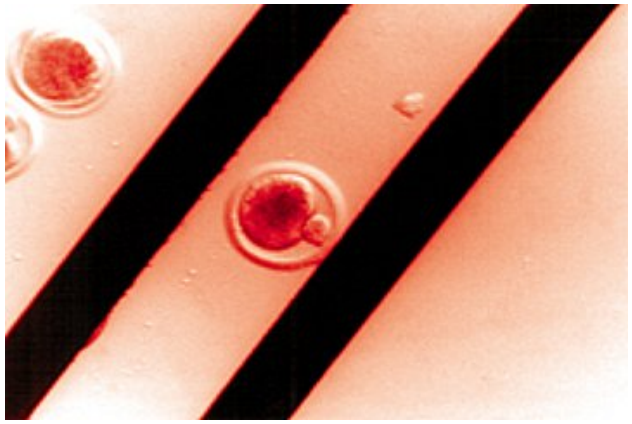


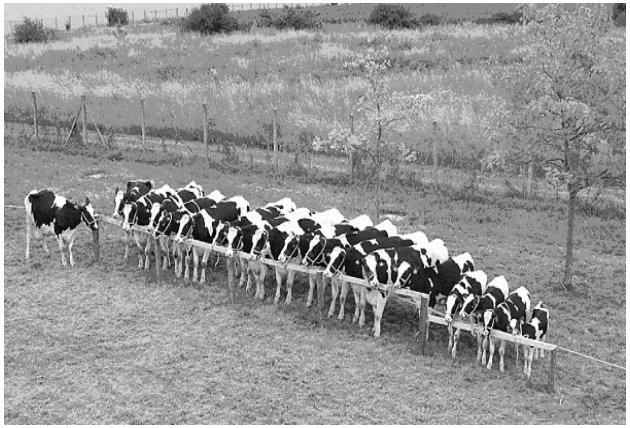
		W	A	J	IV	I	N	C	Ae
		Welfare	Autonomy	Justice	Intrinsic value	Integrity	Naturalness	Caution	Aesthetics
Transgenesis	production animals, transplantation, bio-pharmaceuticals	✘	✘	✘	✘	✘	✘	✘	

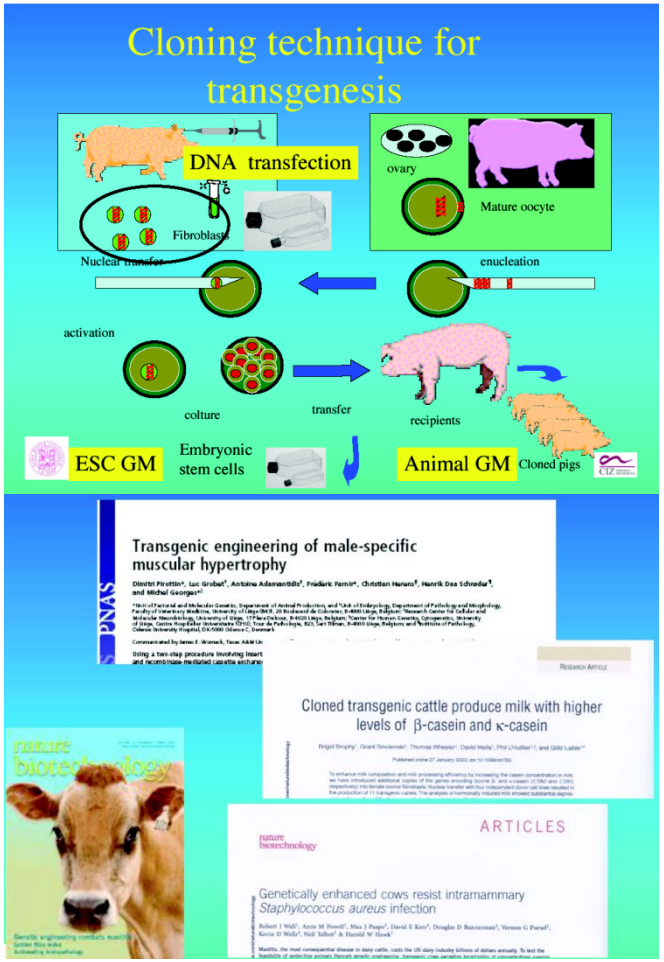
Buning (2000), van Reenen (2001), Verhoog (2003), Kaiser (2004), de Vries (2004), Millar (2006), Montaldo (2006), Gjerris & Sandoe (2006), Hagen (2007), Daar (2007), Greger (2010)

Genetic breeding through cloning









Uses: (Niemann, 2012)

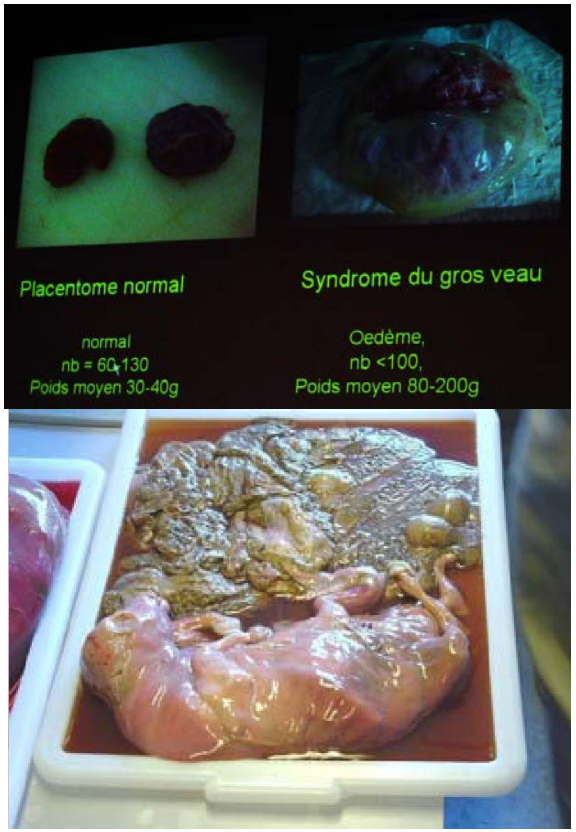
- identical production animals (e.g. meat)
- reproduce outstanding animals (e.g. horse)
- use in selection schemes
- reproduce transgenic animals

Genetic breeding through cloning: drawbacks

Low efficiency	step	global
• oocyte enucleation:	60-92%	
• electro-fusion:	75-90%	
• activation:	60-80%	40%
• blastocyst:	20-40%	
• pregnancy:	20-30%	4%

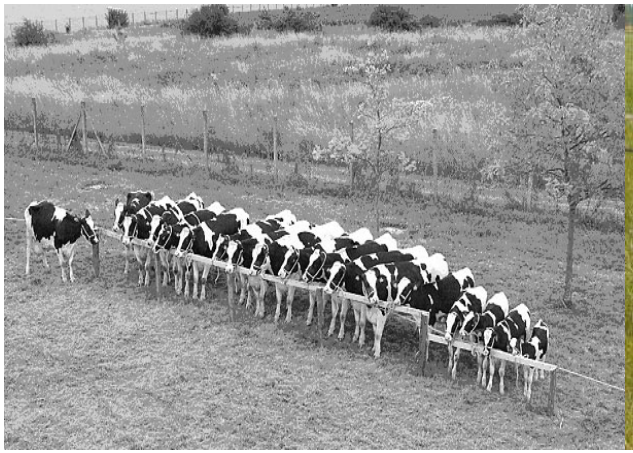
Postnatal mortality (Chavatte-Palmer 2004)

- Large offspring syndrome: 33%
- Thymus atrophy: 15%
- Kidney lysis: 11%
- Internal haemorrage: 11%
- Sudden death: 7%



de Boer (1995)
Gjerris & Sandoe (2005, 2007)
Gonzales (2011)

Genetic breeding through cloning



- identical production animals (e.g. meat)
- reproduce outstanding animals (e.g. horse)
- use in selection schemes
- reproduce transgenic animals

		W	A	J	IV	I	N	C	Ae
Cloning	meat cattle competition horses transgenic clones	✘	✘	✘	✘	✘	✘		

Welfare
Autonomy
Justice
Intrinsic value
Integrity
Naturalness
Caution
Aesthetics

Cases and values

		W	A	J	IV	I	N	C	Ae
Genetic selection	breeding goals,	✘	✘	✘				✘	
	blind hens, featherless chicken, polled ruminants	✘	✘	✘	✘	✘	✘		✘
	artificial insemination	✘	✘	✘				✘	
	embryo transfer	✘	✘	✘		✘	✘	✘	
	in vitro fertilization	✘	✘	✘		✘	✘		
Sex selection	calves, chicken	✘	✘	✘			✘		
Genomic selection	breeding goals	✘	✘	✘		✘	✘	✘	
Transgenesis	production animals, transplantation, bio-pharmaceuticals	✘	✘	✘	✘	✘	✘	✘	
Cloning	meat cattle	✘	✘	✘	✘	✘	✘	✘	
	competition horses transgenic clones								

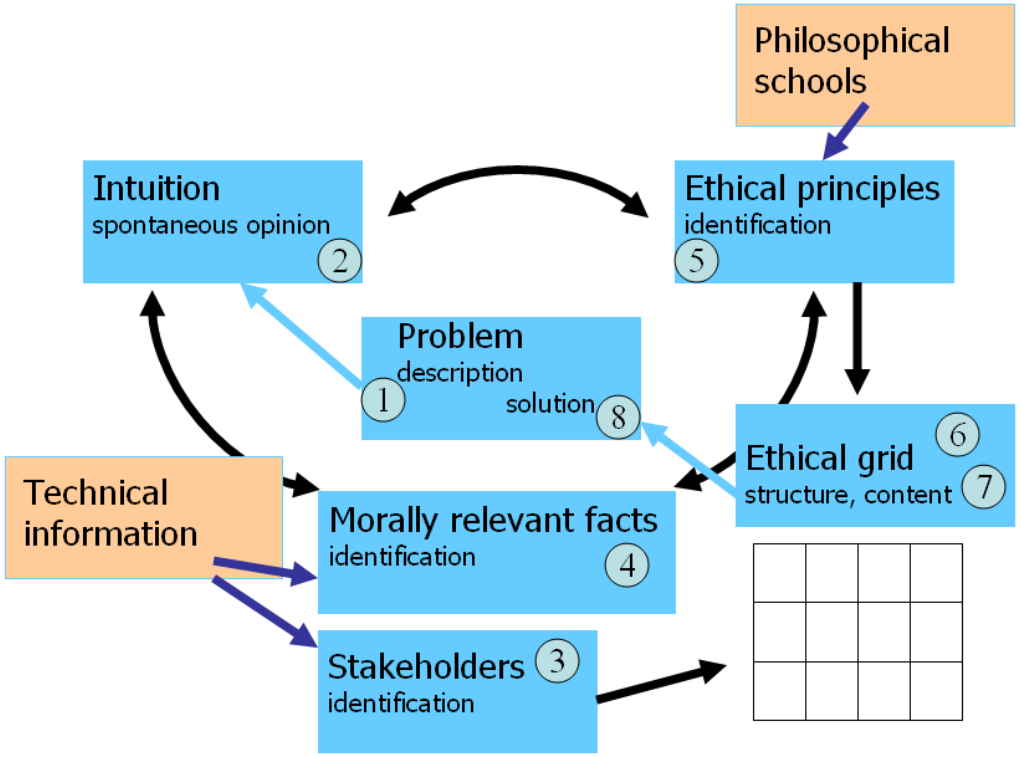
Welfare
Autonomy
Justice
Intrinsic value
Integrity
Naturalness
Caution
Aesthetics

Ethical tools

		Well-Being	Autonomy	Justice
Cows	H	*Welfare*	*Freedom of behaviour*	*Equity of conditions of life*
	D			
	P			
Farmers	H	*Income, Working conditions, Risks*	*Freedom of action*	*Commercial equity*
	D			
	P			
Society	H	*Security, Quality of life*	*Informed choice*	*Affordability*
	D			
	P			
Environment	H	*Conservation*	*Biodiversity*	*Sustainability*
	D			
	P			

The Ethical Matrix

B. Mepham (2000, 2004, 2005)



The Reflexive Equilibrium Method

W. Van der Burg, T. Van Willigenburg (1998)

B. Rutgers (2006)

Conclusions