Animal breeding and ethical values

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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

**Computing**
- Statistical methods
- Bio-informatics
  - Gene mapping

**Molecular Biology**
- DNA, RNA, Proteins ...

**Bio-Engineering**
- Genomic selection

**Genetic Selection**
- Breeds
- Indexes

**Heterosis**

**Breeding**
- Male line
- Female line

**Sex selection**

**Artificial insemination**

**Cryopreservation**

**Embryo transfer**

**In vitro fertilization**

**Transgenesis**

**Nuclear transfer**

**Marker-assisted selection**

**Cloning**
- Genetic modification
- Young stock
- Female line

**EAAP 64th Annual Meeting, Nantes, France, August 26th-30th, 2013**
Actors in breeding: from local to global

- farmers
- local A.I. centre
- local breeding association
- mating station
- breeding organisms
- breeding companies
- research organisations
- biotechnology companies
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<th>Cases and values</th>
<th>Welfare</th>
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Genetic selection and breeding goals

- Increase of productivity: negative effects on health and welfare

- Metabolic disorders, lameness, fertility
- Leg weakness, osteochondrosis

Welfare, autonomy, justice

Genetic selection and breeding goals

- Increase of productivity: major alterations
  - Behaviour
  - Blind hens
  - Featherless chickens
  - Polled cattle

Gjerris & Sandoe (2006)
Fraser (2001), Wells (2012)
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 (2000), 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.


Macnaghten (2004)
### Cases and values

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#### Welfare Autonomy Justice Intrinsic value Naturalness Caution Aesthetics

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Genetic selection through A.I.

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

Olson (2004)
McArther (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)
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)

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Genetic selection | in vitro fertilization

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Genomic selection

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

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

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

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EAAP 64th Annual Meeting, Nantes, France, August 26th-30th, 2013
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

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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**

- 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 haemorrhage: 11%
- Sudden death: 7%

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de Boer (1995)
Gjerris & Sandoe (2005, 2007)
Gonzales (2011)
Genetic breeding through cloning

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Ethical tools

The Ethical Matrix

The Reflexive Equilibrium Method
B. Rutgers (2006)
Conclusions

Enhanced requirement for ethical analysis taking into account pertinent values

Thank you for your attention

Efficiency

Large impact

Quickness

Computing

Statistical methods

Bio-informatics

Molecular biology

Bio-engineering

Genomic selection

Marker-assisted selection

Nuclear transfer

Transgenesis

In vitro fertilization

Embryo transfer

Cryopreservation

Artificial insemination

Invasiveness

Heterosis

Genetic selection