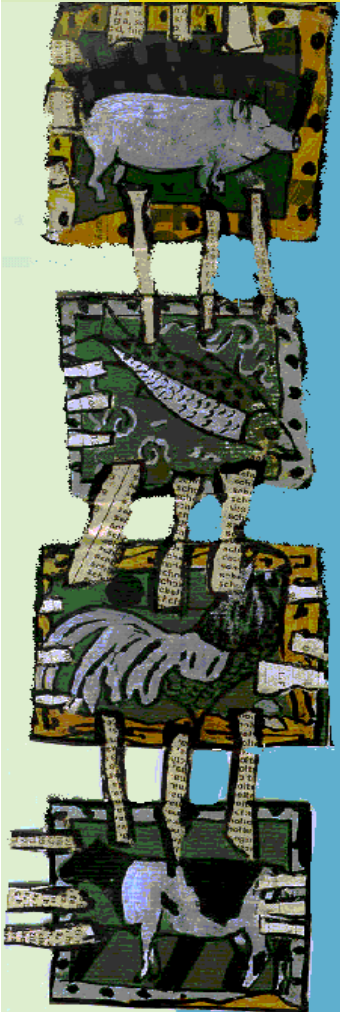


# End-users perspectives and social and ethical aspects of genomics in farm animal production



Jan Merks and Anne-Marie Neeteson  
**Farm Animal Industrial Platform**  
EU workshop, 10 September 2003

# Farm Animal Industrial Platform

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## n Goal

- Forum European farm animal reproduction and selection companies
- Indication research directions
- Stimulate interaction research – industry
- Dialogue with society

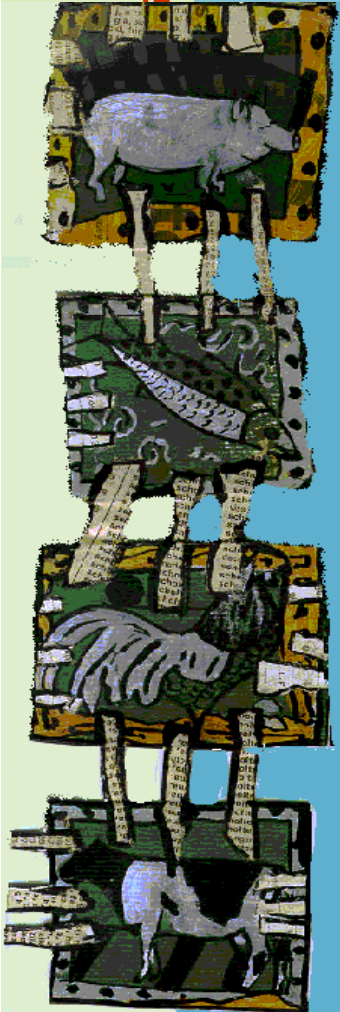
## n Presentation based upon

- Information from FAIP members
- EU-funded projects ELSA + SEFABAR

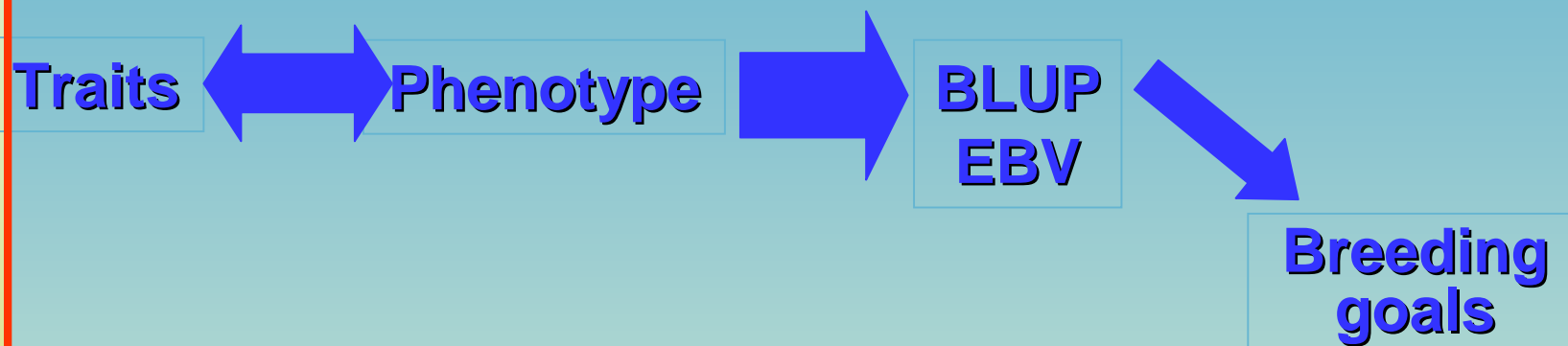
# Lay-out of contribution

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- n **Breeding and Genomics today**
- n **End-user Perspectives of Genomics**
- n **Social and Ethical aspects**
- n **Priorities for Europe**



# Traditional breeding



**Genomics enables use of genomic information instead of “estimated genetic make-up”**

**No use of cloning nor transgenics**

**Selection strategy**

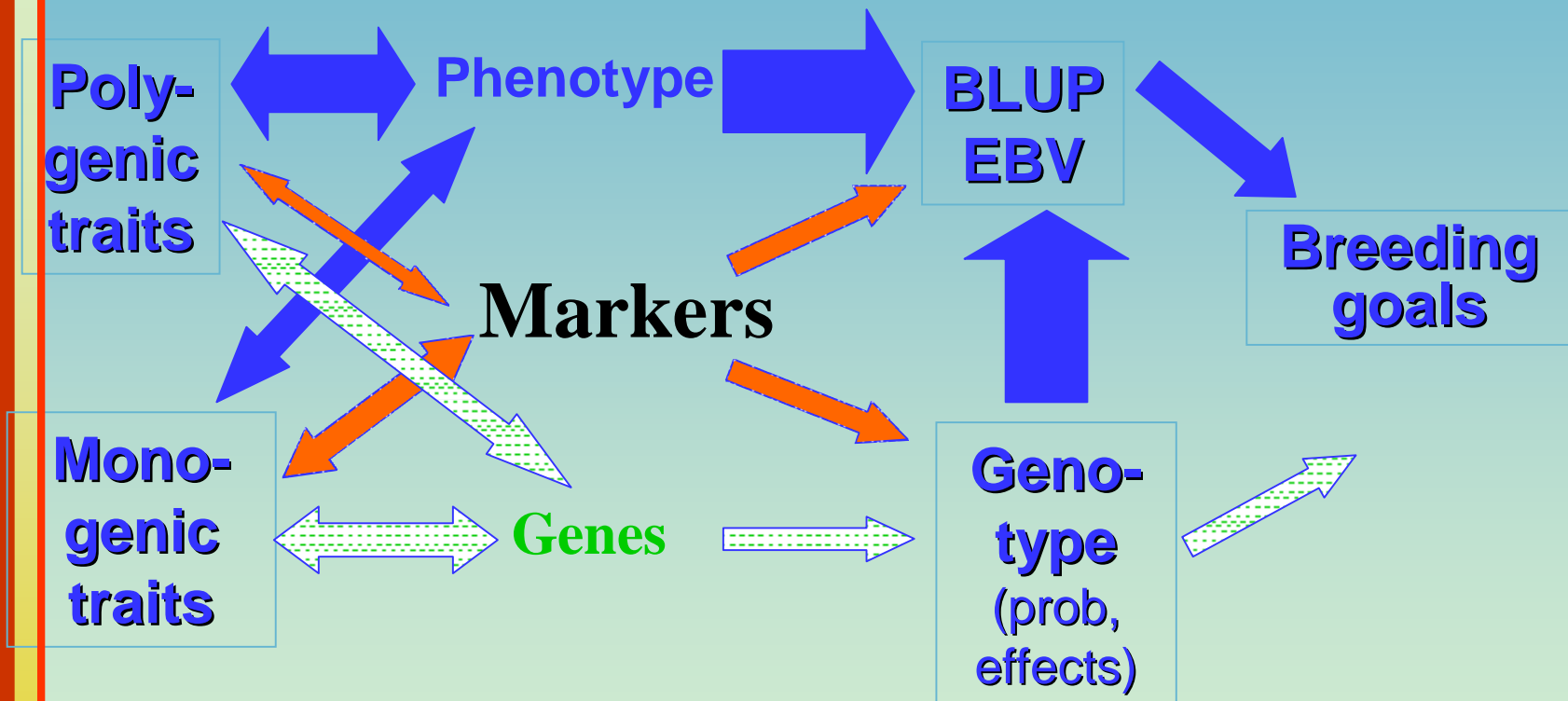
# Breeding and production

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**GOAL breeding:** improve genetic make-up of farm animals with regard to economics of production and marketing of farm animal products (meat, eggs, milk and fish)

**GOAL production:** to produce food of animal origin at a competitive (and market directed) price and quality level

# Traditional breeding and genomics



**Selection strategy**

# Breeding traits of interest for GENOMICS

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Traits difficult or expensive to measure, or to shorten generation interval:

- n Disease resistance traits (costs/welfare)
- n Meat quality traits (animal has to be killed)
- n Longevity related traits (known late in life)

Complex traits: breakdown into physiological pathways and underlying metabolic mechanisms

# In addition to animal production interest in GENOMICS for:

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- n Traceability
- n On-line quality measurements
- n Vaccines and therapeutics
- n Alternatives for antibiotics



# Genomics in farm animal breeding

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## Two major approaches:

- (1) **Candidate gene approach** - choose gene via clinical symptoms or physiological changes from human/mouse
  - è Successful for monogenic traits: esp. inherited defects, some quality traits and coat color
- (2) **Positional cloning approach** - no clear candidate gene evident:
  - linkage analysis pinpoints chromosomal region with unknown gene
  - fine map the region and identify positional candidate gene
- è QTLs are often inconsistent across breeds, recent success for some major genes affecting fertility and quality traits

# Reasons for inconsistent QTL effects

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- Trait definition
- Statistics
  - False positives/negatives (sample size)
  - Overestimation of significant effects
- True effects
  - Farm animal populations are outbred
  - Genotype x environment interaction
  - Epistasis (in crossbreeding)
  - Genetic imprinting

# Lessons from other organisms

General development of tools and techniques

Sequencing of several genomes

Identified human genes  
=> animals:

è >1300 functional mutations identified

è easy by elimination of carrier animals

Plants: identification and use of QTLs,  
BUT è inbred lines and large sample sizes

The screenshot shows a software window titled "Entry Point Services" with a menu bar (File, Services, Help). It lists several services:

- Entrez**: NCBI's Entrez retrieval system, wrapped with ISYS. Description: ENTREZ (NCBI), v1.3, NCGR ISYS Team, (c) 2000-2002 NCGR.
- Ensembl Human**: Queryform for the Ensembl Human Genome Server. Description: Ensembl Human Genome Server.
- Ensembl Mouse**: Queryform for the Ensembl Mouse Genome Server. Description: Ensembl Mouse Genome Server.
- GENSCAN (MIT)**: Identification of complete gene structures in genomic DNA. Description: GENSCAN (MIT), v1.3, NCGR ISYS Team, (c) 2000-2002 NCGR.
- Gene Seeker**: Enhanced GeneSeeker with BLAST functionality. Description: GeneSeeker.
- Google**: General web search engine. Description: Google, v1.3, NCGR ISYS Team, (c) 2000-2002 NCGR.
- Mouse/Human Positions**: Makes a table with gene positions in Mouse and Human from a gene list as input.
- MySQL**: Connect to the database.

At the bottom, there is an "Asynchronous Services" section with a table:

Name	Status	Start	Elapsed	End
[Cancel execution] [Clear Inactive]				

# Lessons/results until today

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- n Success for monogenic traits (esp. inherited defects), but low frequency
- n Many QTLs for polygenic traits but not consistent across breeds (outbred)
- n Gene(s)  $\rightarrow$  trait: complex physiological process due to crossbreeding, epistasis, GxE ....
- n Recent success for functional mutations for polygenic traits along LD-mapping

# Priorities (1)

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- n Active industrial participation from begin
- n Collaboration = IPR (right of first refusal) on European level, not for individual organisation
- n No priority for cloning and genetic modification

# Priorities (2)

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## n Focus EU-research:

- Host-pathogen interaction: zoonoses
- General tools to analyse genetic background of host-pathogen interaction
- Technology and tools to combine genomics with traditional breeding

## n Transparency & communication to public with regard to goal and results of research

# Conclusions for Farm Animals

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- n Limited success until today for genetic make-up but **adequate perspectives for complex traits** like quality and disease resistance
- n IPR open for EU industry and science to enable real **COLLABORATION**
- n **FOCUS** in EU research, also within IPs and NEs

# Social and Ethical Aspects

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## n Two projects:

- Farm Animal Breeding & Society (ELSA)
- Sustainable Farm Animal Breeding And Reproduction (SEFABAR)

## n **Implications** for GENOMICS in farm animals

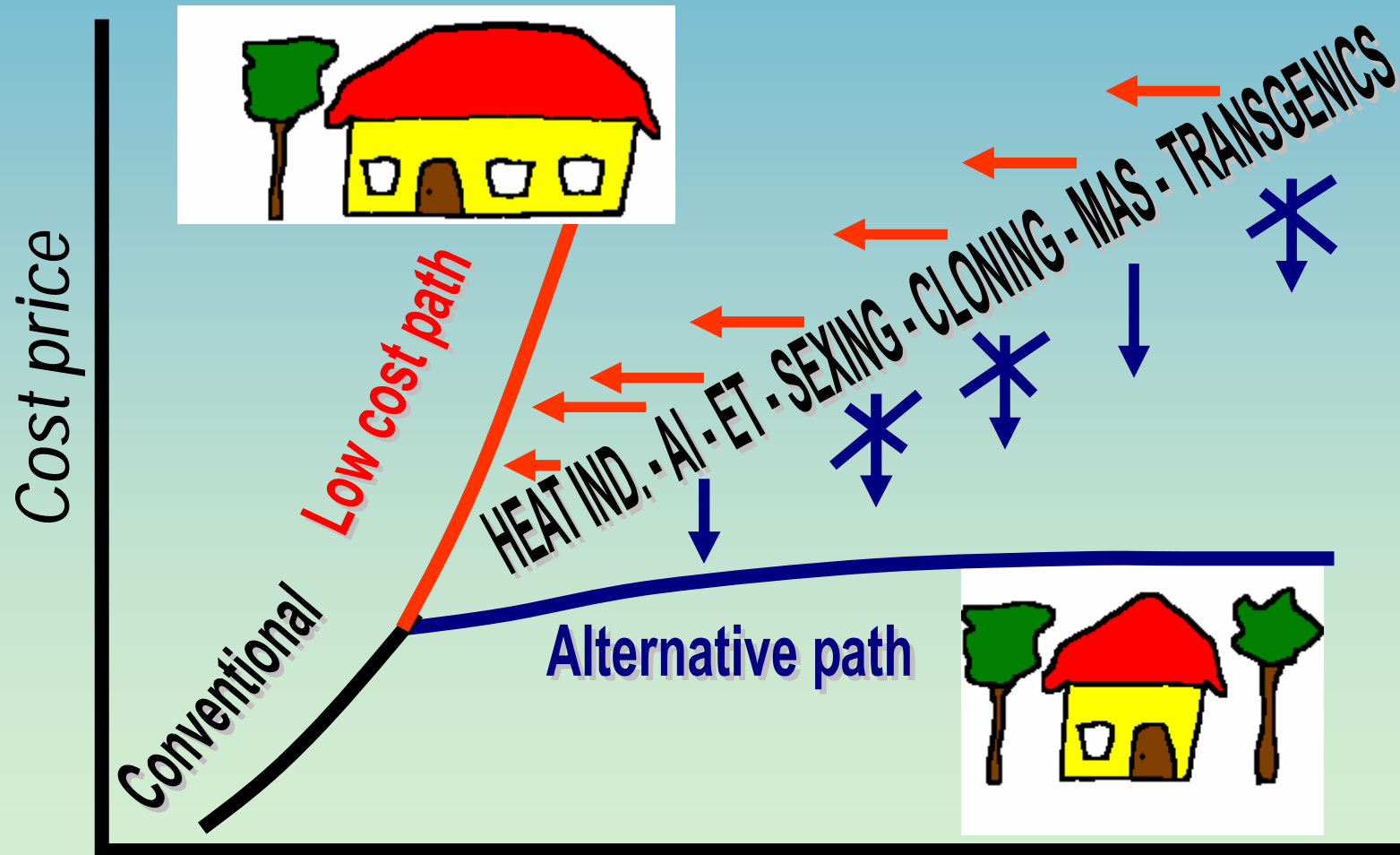


# 1. ELSA

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- 1998-1999
- FAIP and social partners (ethics, law, consumers)
- GOAL:
  - Picture farm animal breeding
  - Ethical, consumer and legal aspects
  - Dialogue and discussion
  - Information for policy makers

# ELSA Breeding and Reproduction



# ELSA Ethics, Law and Consumers

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## n Ethics

- Animal **welfare** major concern
- Call for **transparency and dialogue**

## n Law

- Broad patent claims should be watched
- Animal welfare legislation will influence future breeding work

## n Consumers

- Take **concerns** societal groups serious
- Open dialogue with welfare organisations

## 2. SEFABAR

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- **2000-2003**
- **Network scientists / industry & social partners (ethics, welfare, cultural differences, public opinion, economy)**
- **GOAL:**
  - What is sustainable breeding and reproduction ?
  - Sustainable breeding scenarios
  - Socio-economic studies
  - Integration
  - Information policy makers

# SEFABAR: Breeding and Reproduction

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- n We are faced with **dilemmas**.  
Society accepts choices when you are able to explain your decisions and **communicate** about them

# SEFABAR: Society partners (1)

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## n Animal welfare

- **Critical involvement**
- Knowledge / application regulations poor
- Step 1: further dialogue desired

## n Ethics

- Practical input concepts
  - sustainability
  - scenario building
- Hiding away of issues and covering up about problems represents no **viable long-term strategy**

# SEFABAR: Society partners (2)

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- n Public opinion (INRA, F)
  - Breeders/producers should be **transparent**
  - Technology associated with risk, although also solution for safety/quality/health
- n Cultural differences (WUR, NL)
  - Breeding and society: **two cultures**
- n Economy (Exeter, UK)
  - Sustainability is a **process**, not a no/yes issue

# SEFABAR: evaluation

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- n WE learned a lot, but .....
- n DISCUSSION in person is a MUST
- n Like all projects we had some passengers aboard
- n Sustainability to be implemented in the whole animal production chain
- n **MOST IMPORTANT**: continue with meeting & exchange of information with socio-economic partners: **TRANSPARENCY**



# Conclusions for GENOMICS

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n Society is concerned about:

- Food
- Animals' welfare
- Safety
- New technologies
- Scientists
- Industry

These elements are all present in genomics for farm animals

# Social and ethical aspects

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## **n IMPORTANT: be pro-active**

- Awareness building scientists and industry
- Dialogue with stakeholders and society
- Transparency

**and exercise this**

**BOTH** in industry and research