

# IMPORTANCE OF TRANSGENIC ANIMALS

## ▶ Medical importance

- Disease model
- Bioreactors for pharmaceuticals
- Xenotransplantation

## ▶ Agricultural importance

- Disease resistant animals
- For improving quality and quantity of milk, meat, eggs and wool production

## ▶ Industrial importance

- Toxicity sensitive transgenic animals to test chemicals.
- Spider silk in milk of goat

## TRANSGENIC MOUSE

### ▶ **Alzheimer's mouse**

- In the brain of Alzheimer's patients, dead nerve cells are entangled in a protein called amyloid.
- Mouse made by introducing amyloid precursor gene into fertilized egg of mice.



### ▶ **Oncomouse**

- Mouse model to study cancer
- Made by inserting activated oncogenes.

### ▶ **Smart mouse**

- Biological model engineered to overexpress NR2B receptor in the synaptic pathway.
- This makes the mice learn faster like juveniles throughout their lives.

## TRANSGENIC LIVESTOCK

- ▶ Bioreactors whose cells have been engineered to synthesis marketable proteins.
- ▶ More economical than producing desired protein in cell culture.
  
- ▶ **Transgenic cattle**
  - Transgenic cows are made to produce proteins lactoferrin and interferons in their milk.
  - Prion free cows resistant to mad cow disease.
  
- ▶ **Transgenic sheep**
  - For good quality wool production.
  
- ▶ **Transgenic goat**
  - Goats that could express tissue plasminogen activator, anti thrombin III, spider silk etc in milk.



## Transgenic chickens

- **Methods:**
  - Infecting embryos with a viral vector carrying the transgene
  - Transfer human gene into rooster sperm
- Produces 0.1g of human protein in each egg
- **Advantages:**
  - Cost effective
  - Add correct sugars to glycosylated proteins (unlike E.coli)



## Transgenic cow

- 1990: World's 1<sup>st</sup> transgenic cow – "Herman" the bull (Netherlands)
- Herman carried the human lactoferrin gene (pronuclear microinjection)
- Cow's milk & artificial formula do not naturally contain lactoferrin
- Other RPs in transgenic cow's milk – lysozyme, human lactalbumin, rATIII, Factors VIII & IX etc



## **ISSUES RELATED TO TRANSGENIC TECHNOLOGY**

- ▶ **Blurring the lines between species by creating transgenic combinations.**
- ▶ **There may be health risks associated with transgenics.**
- ▶ **There may be long term effects on the environment when transgenic animals are released into the field.**
- ▶ **Various bioethicist argue that it is wrong to create animals that would suffer as a result of genetic alteration.**

## RECENT TRENDS

- ▶ **Transgenic goats engineered to produce human breast milk** (*Journal Transgenic Research*, August 2012)
  - University of California scientists created the transgenic goats by transferring human genes for breast milk enzymes and proteins into goat embryos.
  - Produce 60 percent of the lysozyme and lactoferrin found in human mother's milk.
  - For babies of mothers who aren't present, or can't nurse them, milk from these transgenic goats could provide the next-best alternative.
  
- ▶ **Bioluminescent transgenic mouse model for study mammary gland tumour development.** (PLoS ONE, aug 2012)
  - Research done by Cancer Biology and Therapeutics Group, Ireland

➤ **Step 2 - Introduction of Transgene into the animal**

3 methods –

1. RETROVIRAL VECTOR METHOD.
2. DNA MICROINJECTION METHOD (PRONUCLEUS METHOD)
3. EMBRYONIC STEM CELL-MEDIATED SITE-DIRECTED MUTAGENESIS