12.3 Transgene and transgenic animals

This section only gives a very short introduction of the topic. Only the main themes are summarized.

Methods for gene transfere: Micro injection of DNA into the paternal pro nucleus right after fertilization of the oocyte. The success rate is low, a few per thousand. There is always the risk of insertional mutageneses, i.e. the introduced gene inserts itself into a functional part of another gene and thus ruins its functions. Micro injection or other forms of gene transfere into embryonal stem cells or other types of pluripotent cells by use of homologous recombination. After selecting for the transgene cells, which is possible in a cell culture. Selection for the recombinated cells can be done by means of a linked which, is part of the construction. Cultivation methods for foetal stem cells are only fully developed for mice. It is still on a trial basis for all of our domestic animal species.

After transgenesis in ES, or other foetal cell, the transgenic cells are injected into a blastocyst. Then a chimeric animal is formed, some of these transgenic would form gametes containing the inserted gene construction.

Homologous recombination. The targeting of genes becomes possible by means of homologous recombination. This is of great significance to study the function of an unknown gene (with known DNA-sequence). By means of homologous recombination so called 'knock out' mice can be created with a destructed gene function. By investigating the offspring of the 'knock out' mice it is possible to identify the function of a gene, which is completely unknown. So the 'knock out' mice have become the modern test tubes for identification of the functions of a gene.

Gene constructions.
A transgene is normally composed of a promotor and a structural gene. The promotor decides when and where the expression of the gene occurs. If the gene is to be expressed in the mammary gland the casein promoter is often utilized, as the casein is one of the important milk proteins. The structural gene is either with or without introns. If the gene originates from a bacteria, it is always without introns. Genes originating from eukaryotee can be cDNA or genomic. The genomic genes are normally very large, which is a problem. The larger the construction the more difficult it is to make a functional transgenic animal.

Motives for transgenesis.

- The gene needs to have a large effect on the trait in question, for instance at least four times sigma_A
- The gene should add completely new metabolic abilities, for instance the forming of an essential amino acid.
- The gene should add resistance against a serious disease, which have no cure.

Other motives for transgenesis

Gene farming - production of drugs

Organ donation -xeno transplantation
Many medical companies have started the experimentation and production of drugs by means of transgenic animals. Normally, a single animal can produce sufficient drugs for the world market, so the topic is of little importance for this section. The same applies for organ donation, an example is the use of a swine heart for a human. In order for this technique to work it is necessary to knock out most of the strong ordinary antigenic systems in swine. This is difficult, but what is worse is that the xeno transplantation is dangerous. It is well known that modern pests in humans, AIDS etc., stem from the animal world. It is a well known fact that swine carry a lot of endogenous retro viruses. They could be a large potential hazard to mankind if extensive xeno transplantation is used.