Genetically modified animal models

Introduction

The ageing population had engendered a large increase in diseases for which we have no cures including metabolic disorders (e.g. diabetes), neuronal dysfunction (Alzheimer's, Parkinson's), and other degenerative diseases. In addition there is a renewed threat of infectious diseases that are either resistant or untreatable (HIV, malaria, hepatitis, tuberculosis). Meeting those challenges requires more sophisticated applied and basic research tools and targeted medical care. To solve the major medical needs that our society is facing better genetic models for disease are essential. Susceptibility to disease is genetically influenced and the newly available resource of human and other genome sequence information allows us to understand human and animal diseases and develop meaningful genetic animal models.

What are GM animals?

Genetically modified animals are organisms in which specific genes have been altered (added or ablated), which can be used to create models for human and animal diseases. The introduction of a gene can also generate therapeutic medicinal products. Standard genetically modified animals include laboratory flies, fish, worms, rodents and (for agricultural or production purposes) pigs, sheep and cows. In no case is genetic modification of man implied.

Benefits

- Development and testing of safe and effective products for human application (e.g. human antibodies)
- The production of recombinant products (anti coagulant; therapeutic antibodies)
- A means to study disease mechanisms in a complex organism (diabetes)
- Understanding the mechanistic causes and pathways underlying human disease, to permit the development of efficient and targeted treatments (eg leukemia, hypertension, obesity)

The major applications for genetically modified animals in agriculture are:

- To generate animal with desired breeding traits (e.g lower phosphorous in the dung)
- To induce resistance against disease (e.g. fish farming)

The three R's and generation of GM animals

The use of genetically modified mammals (mainly mice and rats) represents an essential tool in biomedical research. However, in many cases simpler organisms like fruit flies, laboratory worms, and fish can replace mammalian models for obtaining fundamental understanding of molecular pathways. Genetically modified lower organisms collectively contribute to replace mammals and therefore, play a major role in the 3R (Reduction, Refinement, Replacement) paradigm to reduce animal use in research. The genetic models add a significant increase in the quality and efficacy of research for human disease.   The use of lower organisms cannot, however, adequately mimic human physiology, so that rodents and larger animals are emerging as a necessary model for biomedical research.

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