Genetically modified animals in biomedical research

Scientists can now alter the genetic code - the very blueprint of life. Some people claim that this holds great promise for the future of medical research. But is it true, and what does it mean for animals?

What are genes?

Every living thing has a genetic code, inherited from its parents, which determines how it will grow and what it will grow into. As a human being, you have approximately 20-25,000 genes, contained in 46 chromosomes, found in the nucleus of most cells. The genes are composed of DNA, which helps to build the proteins that construct and control the body. Different genes are responsible for physical characteristics such as hair and eye colour. Some genes are responsible for genetic defects, such as cystic fibrosis.

What are genetically modified animals?

Genetically modified (GM)[1] animals have had their DNA changed in some way by adding, changing or removing certain genes, to give them a specific characteristic such as disease resistance, or to introduce a new trait, such as faster growth.[2]

Animals with the desired characteristics will usually be used to breed more GM animals for use in a particular area of research.[3]

GM animals in biomedical research

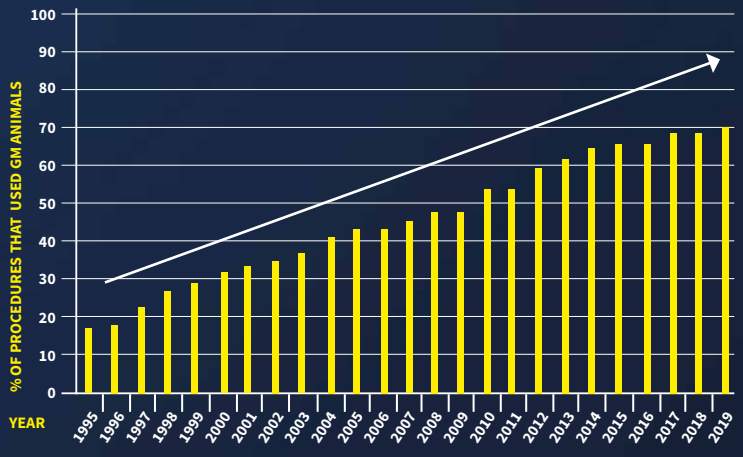
Animals have been used in experiments for decades in an attempt to find cures for diseases that affect people. The problem is that because of the biological differences between species, the results from animal experiments are often unreliable when applied to people.

In an attempt to overcome these problems, scientists are now using genetic engineering technology to try to create genetically modified animals that mimic human disease.

Researchers have attempted to produce 'mouse models' of almost every human ailment[4], including Alzheimer's disease[5], cancer [6], heart disease[7], lung disease[8], diabetes[9] and even obesity. [10]

The use of genetically modified animals has rapidly increased over the last 20 years. In 2019, 42% of the animals used in experiments were genetically modified.[11]

Percentage of scientific procedure that used genetically modified (GM) animals*
(Figures in millions)



* This includes animals used in experiments as well as animals used for the breeding and creation of GM offspring.

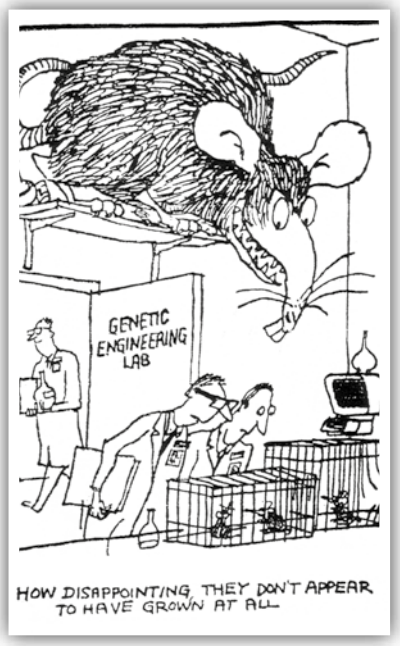
The vast majority of GM research animals are mice. The mouse is the species of choice principally because they are easy to breed and house on a large scale, rather than because of any close genetic similarity to humans. In 2019, 87% of the animals who were genetically modified for use in experiments were mice.[12]

The creation of GM animals for use in biomedical research

There are two main types of GM mice: transgenic mice and knockout mice.[13]

Transgenic animals are created by inserting foreign, or altered, genes into their genome. An example of a transgenic mouse is the 'oncomouse', which has had a gene (called an oncogene) added to its genome that promotes the development of cancerous tumours.[14]

Knockout animals are created by 'disabling', or 'inactivating', one (or more) of their genes. Many of these mouse models are named after the gene that has been inactivated. For example, the p53 knockout mouse is named after the p53 gene, which codes for a protein that normally suppresses the growth of tumours by arresting cell division. P53 knockout mice are more prone to contracting cancer. Knockout mice are often used to study the role of particular genes, such as p53.[15 16]



Mutagenesis is another process. This usually involves injecting animals with chemicals that damage their DNA so that they give birth to offspring who are born malformed.[17 18]

CRISPR is a relatively new technology that can be used to edit the genes of animals, plants and micro-organisms. It is usually used to alter a piece of DNA but it can also be used to turn genes on or off without altering their sequence.[19]

There are now hundreds of different types of GM mice available commercially. They are marketed just like any other piece of laboratory equipment.

Suffering of GM animals

GM animals are often created with defects, which can cause a great deal of physical and mental suffering. For instance, mice have been genetically modified to develop cancer[20], or develop fatal heart failure,[21] which can involve them in suffering severe swelling, breathlessness or massive internal bleeding before they die.[22 23]

The animals created are then often subjected to painful and distressing experiments. For example, in depression studies, mice may be placed in a beaker of water from which they cannot escape, and monitored as they move in frantic attempts to save themselves from drowning through despair, defeat and immobility.[24 25]

Many researchers claim that using genetically modified animals will make the experiments that are carried out on them more reliable. But GM animals are still not the same as people – for example, mice genetically altered to suffer from Alzheimer's disease have failed to accurately reproduce the disease.[26 27]

Mice are not people

Mice share around 80% of their genes with human beings[28], but the way those genes work varies greatly between the two species – which is why humans and rodents look and behave so differently. Adding, subtracting or altering a gene or two does not overcome the biological differences between humans and rodents. This is why researchers are unable to reproduce diseases in GM mice that are sufficiently similar to those experienced by people; and also why drugs and other treatments tried out on mice often fail to work in the same way in human patients.[29 30 31 32]

What you can do to make a difference:

- Join Animal Aid and help to campaign against animal experiments
- Visit our website to order a free *End animal experiments* action pack
- Ask your teacher if someone from Animal Aid can come to your school to give a talk on animal experiments or animal rights.

Glossary

DNA: Deoxyribonucleic acid. The material inside the nucleus of most cells, that carries the genetic information of a living being.
Gene: The basic unit of genetic material inherited from our parents. Genes are made up of DNA. Some genes contain the instructions to make proteins.
Genome: The complete set of DNA within an organism.
Oncogene: A gene that has the potential to cause cancer.
Transgenic: an organism that has undergone genetic modification and has had genes transferred from another unrelated organism.

For more information on animal issues, please contact: Animal Aid, The Old Chapel, Bradford St, Tonbridge, TN9 1AW
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For the references, see the *GM animals in biomedical research* factsheet on our website

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