GENETICALLY MODIFIED ANIMALS

What is the failure rate of animal testing?

Despite efforts to improve the predictability of animal testing (through the use of genetic modification), the failure rate has actually increased and is now closer to 96%.

What are the main benefits to using Non Animal Methods (NAMs)?

Non animal methods are more accurate at predicting human responses to new drugs, they are cheaper than using animal models, you get quicker results, they cost less money and of course, they don't involve any cruelty towards animals.

Most people accept that genetically engineering humans is morally unconscionable, so why is it accepted on animals?

Most animals that are genetically modified are produced for use in laboratory research. These animals are used as "models" to study the function of specific genes and, typically, how the genes relate to health and disease.

Some genetically modified animals, however, are produced for human consumption.
i.e. Genetic modification can increase the yield from farm animals, for example cows can be engineered to produce more milk for the same size of herd.

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Is genetically modifying animals ethical though?

Genetic engineering violates animal rights because they involve manipulating animals for human ends as if the animals were nothing more than human property, rather than treating the animals as being of value in themselves. We also seem more concerned about the danger that these animals may pose to human beings (usually to human health), rather than any implications for the animals themselves.

If genetic edits are made to embryos, or to egg or sperm cells, these changes will be inherited by all future generations. This is perhaps one of the greatest ethical concerns of this type of gene editing as any edits will have a ripple effect and will be passed down to generation after generation. Genetic engineering often involves modifying animals for reasons that have no benefit for that species and could potentially cause them pain and discomfort.

Have beagles been genetically modified?

Yes, in China, scientists removed copies of a gene called the myostatin gene in beagles. The scientists created dogs with a genetic mutation that can cause the dogs to build up twice the muscle mass of normal beagles.

They injected 35 edited embryos into 10 dogs, eight of which became pregnant. Those eight dogs gave birth to 27 puppies, but only two showed the genetic modification they'd been aiming for: a male named Hercules and a female named Tiangou. The gene editing processes are hugely unreliable.

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What is a transgenic animal?

Transgenic animals are animals that have been deliberately bred for research and that contain elements of two different species - they are creatures that blur the barrier between species. These animals are often deliberately created with genetic defects, and these defects may well cause the animal to have a bad quality of life.

In 2009, scientists in South Korea created a cloned beagle named Ruppy who is the world's first transgenic dog - she and four other beagles all produce a fluorescent protein that glows red under ultraviolet light because the scientists conducting the experiment used a retrovirus to transfer the fluorescent gene so they had no control over where it ended up in the dogs DNA.

Is genetically modifying animals human relevant?

Animal approaches increasingly appear to be of poor human relevance, due to the very genetic differences that make species dissimilar and unique, some scientists have modified genes in animals used in experiments to attempt to overcome these differences and make them more relevant to human biology.

What seems commonplace however, is the unfortunate and groundless assertion that genetic modification will instantly make failed animal models more human relevant. Evidence suggests otherwise.

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How do scientists genetically modify animals using CRISPR technology and what are the risks involved?

It works by cutting into a DNA sequence at a specific genetic location. It then deletes or inserts DNA sequences, which can change a single base pair of DNA, large pieces of chromosomes or regulation of gene expressions levels.

The most well-known risk with CRISPR is that the Cas9 enzyme, which is supposed to slice a specific DNA sequence, will also make cuts in other parts of the genome that could result in mutations that raise the risk of cancer.

A recent study showed CRISPR selects cells with specific cancer associated mutations for survival. This study showed that pre-existing cancer driving mutations of two genes, p53 and KRAS, are selected during CRISPR gene editing in many diverse cells.

p53 is a tumour suppressing gene that works by stopping cell growth if there is damage to the genome and initiating programmed cell death to prevent the cell from becoming cancerous.

The KRAS gene is an oncogene, which means that when it is mutated it can cause normal cells to become cancerous. KRAS mutations are found in approximately 25% of tumours, and 85 to 90% of pancreatic cancer cases.

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What is the response from Animal Free Research on the use of CRISPR technology?

"CRISPR can be used to modify human cells in the laboratory, in cell culture and organ-on-a-chip models to deliver data from human sources that is directly relatable to human diseases.

We urgently need to accelerate towards personalised medicine that is patient-focussed, and not rely on genetically altered animals who can never accurately replicate a human patient in all their rich complexity.

The only solution – both ethically and scientifically – is to invest in human models of disease. That's why Animal Free Research UK is funding a pilot study using CRISPR to create human stem cell disease models for the study of vascular dementia at the University of Manchester.
And it's why we have a new three-year project about to launch at the University of Nottingham that will develop stem cell models to understand heart disease using CRISPR.

Nobel Prize winning CRISPR can be a game-changer for animals as well as for patients – if researchers have the courage and imagination to do things a little differently."

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What alternatives do we have to genetically modifying animals?

Modelling human diseases in cultured human stem cells continues to take great leaps forward and will surely become a mainstay of biomedical research that “could rival the use of GM mice in popularity”.

Somatic cells (cells from various parts of the body, often skin biopsies or blood) can now be reprogrammed to act as cells in early-stage embryos, able to develop into many different specialized cell types.

The development of 3D cell cultures and organoids (cultured miniature organs) is likely to increase the in vivo relevance of this approach, with more faithful and accurate cellular phenotypes which are human relevant.

Organoids successfully developed to date include, brain, intestine, stomach, salivary gland, esophagus, pancreas, liver, breast, lung, prostate, fallopian tube, and taste bud.