

### The Three Rs

The principles for humane animal research are:

**Replacement** – avoiding using ‘protected’ species (including all vertebrates) by using human volunteers, computer models and cells taken from killed animals or from invertebrates

**Reduction** – improving efficiency by sharing data, getting more information from each animal and using fewer animals

**Refinement** – improving animal welfare and minimising suffering, such as using anaesthetics and reducing stress. For example, providing nesting opportunities for mice.

NC3Rs works with scientists to improve animal experiments worldwide.



National Centre  
for the Replacement  
Refinement & Reduction  
of Animals in Research

### Cats and spinal cord injury

50,000 people in the UK live with paralysis as a result of spinal cord injury. In the 1990s, experiments on cats revealed a number of possible treatments that might lead to some recovered function.

Clean incisions to the spinal cord were made to 19 cats under anaesthetic. They were allowed to recover naturally. The incisions were designed to sever a particular group of nerve fibres and were limited to part of one side of the spinal cord, so as to minimise consequent disability for the animals.

The cats were able to walk on four legs again within the first week and were walking near-normally after three weeks. They were carefully monitored throughout to prevent distress and received post-operative painkillers. After 18 weeks they were given additional anaesthetic and painlessly killed. Post-mortem analysis was then conducted on relevant sections of spinal cord.

### Singer on unnecessary experiments

Three experimenters at Princeton kept 256 young rats without food or water until they died, concluding young rats under conditions of fatal thirst and starvation are much more active than adult rats given food and water.

H. F. Harlow reared monkeys under conditions of maternal deprivation and total isolation. He could reduce the monkeys to a state in which, when placed among normal monkeys, they sat huddled in a corner in a state of persistent depression and fear; monkey mothers were so neurotic that they smash their infant's face into the floor and rub it back and forth.

The benefits to humans are either non-existent or very uncertain; while the losses to members of other species are certain and real. Hence the experiments indicate a failure to give equal consideration to the interests of all beings, irrespective of species.

### Primates and Alzheimer's

Primate and human brains share structural and functional similarities. Experiments on primates are rare, making up less than 0.05% of animal experiments.

500,000 people in the UK and 44 million worldwide have Alzheimer's, costing around £500 billion a year, but the greatest cost is to sufferers and their families.

In 2014, researchers in Rio De Janeiro injected the brains of macaques and after a month detected features of Alzheimer's not seen in mice. One week after injections ended, the authors sacrificed the animals and analysed the brains for pathology.

Researchers in China used CRISPR to genetically modify monkeys to create genetic faults seen in humans with Alzheimer's.

### Alternatives to CRISPR on primates

Dr Andrew Bennett, a scientist with the Fund for the Replacement of Animals in Medical Experiments (Frame), said: "Whilst the technological advances in genetic engineering are to be both applauded and admired, their subsequent use to produce genetically modified monkeys is questionable at best.

"Frame would call for more funding to be used to produce model systems based on human tissues and cells rather than try to develop more sophisticated laboratory animal species. If you're working on human disease, then it is necessary to use human-derived material to predict human responses."



### Other alternatives to animals

- *in vitro* (test tube) test methods and models based on human cell and tissue cultures
- computerised patient-drug databases and virtual drug trials
- computer models and simulations
- stem cell and genetic testing methods
- non-invasive imaging techniques such as MRIs and CT Scans
- microdosing (in which humans are given very low quantities of a drug to test the effects on the body on the cellular level, without affecting the whole body system)