Information Sheet 3 - The 3 Rs (Science)

The principles of the 3Rs - Replacement, Refinement and Reduction - were developed as criteria for humane animal use in research and testing.

Replacement
Replacement refers to the use of non-animal methods instead of animals to achieve a scientific aim. Safety testing is probably the area where most progress has been made in the development of direct replacements for animals.

The non-animal techniques are:

- **in vitro techniques**, involving the study of isolated molecules, cells and tissues (which may come from humans, animals, micro-organisms or even plants). This gives useful information about interactions between molecules, within or between cells, or about organ function.

- **study of human beings and populations.** Research on human subjects can give very useful information about the body in health and disease, and about the distribution of diseases in society, but is limited by what is considered ethical. New non-invasive scanning techniques make it possible to study blood flow or nerve activity in the living human brain, for instance.

- **Computers** and chemical techniques can screen out harmful or useless compounds before they ever get to the animal testing stage.

- **Genetic studies** are a growing area of research, and may be carried out at molecular and cellular levels. But they often lead directly to the use of more animals, to study the effect of particular genetic changes in living beings.

- **Microdosing** is a new method being developed. It involves giving human subjects a drug dose one-hundredth of what would be necessary for it to have an actual effect on the body and watching what the body does with it. With the aid of accelerator mass spectometry (AMS) — an incredibly sensitive measuring technique, which can pick up minute traces of a drug in the human body — the metabolic fate of a drug administered in trace doses can be followed. It may allow scientists to watch the metabolism of new drugs in the human body with no risk. (THE TIMES The Human Guinea Pigs 17/12/05 http://www.curedisease.net/articles/051217.shtml)

Refinement
Refinement refers to methods which alleviate or minimise potential pain, suffering or distress, and which enhance animal welfare, for those animals which still have to be used. Refinement can be achieved by, for example, using appropriate anaesthetics, training

animals to co-operate with certain procedures (e.g. taking blood samples) so the animals are less stressed, and ensuring that accommodation meets the animals' needs (e.g. providing opportunities for nesting for rodents). There is evidence that refinement not only benefits the animals, but also improves the quality of the research findings.

The 'mouse house' is a refinement developed at the MRC National Institute for Medical Research. The transparent, red, plastic house provides mice with an area to nest, hide and climb. The mouse house appears dark to the mice as they cannot see red, yet the transparent walls mean that animal care staff can see the mice at all times and so are able to carry out their daily checks without disturbing them

Reduction
Reduction refers to methods which enable researchers to obtain comparable levels of information from fewer animals, or to obtain more information from the same number of animals. Improved experimental design and statistical analysis are means of achieving reduction. The National Centre for 3Rs recently awarded a prize to a scientist who developed a way of reducing the number of animals used in a specific piece of research:

In her research, Dr Wiles infects mice with bacteria from the same family as E. coli to study the paths of infection. Traditionally, every mouse has been infected by putting a tube down its throat to deliver the bacteria to the stomach - a process called gavage. Dr Wiles tried infecting only one mouse in this way, then putting it in a cage with uninfected mice and letting nature take its course. The results showed higher infection rates than the traditional technique. But more importantly, the research was refined so that far fewer animals were subjected to gavage, and the new approach also reduced the total number of animals used by improving the reliability of infection.

Adapted from
The National Centre for the 3Rs website:
The 3Rs: http://www.nc3rs.org.uk/page.asp?id=7
The NC3Rs Prize: http://www.nc3rs.org.uk/page.asp?id=149
The RDS website:

Non- Animal Research Methods:
http://www.rds-online.org.uk/pages/page.asp?i_ToolbarID=2&i_PageID=33http://www.rds-online.org.uk/pages/page.asp?i_ToolbarID=4&i_PageID=148