## 'Miracle mouse' can grow back lost limbs

Jonathan Leake, Science Editor

Scientists have created a "miracle mouse" that can regenerate amputated limbs or badly damaged organs, making it able to recover from injuries that would kill or permanently disable normal animals.

The experimental animal is unique among mammals in its ability to regrow its heart, toes, joints and tail.

The researchers have also found that when cells from the test mouse are injected into ordinary mice, they too acquire the ability to regenerate.

The discoveries raise the prospect that humans could one day be given the ability to regenerate lost or damaged organs, opening up a new era in medicine.

Details of the research will be presented next week at a scientific conference on ageing, Strategies for Engineered Negligible Senescence, at Cambridge University. Ellen Heber-Katz, professor of immunology at the Wistar Institute, an American biomedical research centre, says that the ability of mice at her laboratory to regenerate appears to be controlled by about a dozen genes.

She is still researching their exact functions, but it seems almost certain that humans have comparable genes.

"We have experimented with amputating or damaging several different organs, such as the heart, toes, tail and ears, and just watched them regrow," she said. "It is quite remarkable. The only organ that did not grow back was the brain.

"When we injected foetal liver cells taken from those animals into ordinary mice, they too gained the power of regeneration. We found this persisted even six months after the injection."

Heber-Katz made her discovery when she noticed that the identification holes that scientists punch in the ears of experimental mice healed without any signs of scarring.

The self-healing mice, from a strain known as

MRL, were then subjected to a series of surgical procedures. In one the mice had their toes amputated — but the digits grew back, complete with joints.

In another test some of the tail was cut off but also regenerated. Then the researchers used a cryoprobe to freeze parts of the animals' hearts, only to see these grow back again. A similar phenomenon was observed when the optic nerve was severed and the liver partially destroyed.

Heber-Katz will describe some of her findings at the Cambridge conference and plans to publish her results in a research paper. "We have found that the MRL mouse seems to have a higher rate of cell division," she said. "Its cells live and die faster and get replaced faster. That seems to be linked to the ability to regenerate."

The researchers suspect that the same genes could confer greater longevity and are measuring the animals' survival rate. The mice are, however, only 18 months old and the normal lifespan is two years so it is too early to reach conclusions.

Scientists have long known that less complex creatures have an impressive ability to regenerate. Many fish and amphibians can regrow internal organs or even whole limbs.

Humans can regenerate their liver provided at least a quarter remains intact, as well as their blood and outer skin, but no other organs regrow.

This is probably because, although most mammalian cells start off with the potential to develop into any cell type, they soon become very specialised. This allows mammals to develop more complex brains and bodies but deprives them of the power of regeneration.

By contrast, if a newt loses a limb then cells around the injury revert back into so-called stem cells. These can develop into whatever types of cell are needed, including bone, skin or nerves.