

# DOLLY THE SHEEP – THE FIRST CLONED ADULT ANIMAL



Professor Sir Ian Wilmut and Dolly the Sheep.

In 1996, University of Edinburgh scientists celebrated the birth of Dolly the Sheep, the first mammal to be cloned using adult somatic cells. The Edinburgh team's success followed its improvements to the single cell nuclear transfer (SCNT) technique used in the cloning process.

Dolly became a global scientific icon and SCNT technology has spread around the world and has been used to clone multiple farm animals.

The cloning of livestock enables growing large quantities of the most productive, disease-resistant animals, thus providing more food and other animal products.

Professor Sir Ian Wilmut (Inaugural Director of the MRC Centre for Regeneration and Professor at the College of Medicine & Veterinary Medicine at the University of Edinburgh) and colleagues worked on methods to create genetically improved livestock by manipulation of stem cells using nuclear transfer. Their research optimised interactions between the donor nucleus and the recipient cytoplasm at the time of fusion and cell division.



## CLONING IN COMMERCE AND AGRICULTURE: PRESERVATION OF LIVESTOCK DIVERSITY

SCNT technology has been widely adopted and used to create clones of other animals (e.g. cows, deer, ferrets, goats, horses, mice, mules, pigs, wolves, rats, rabbits, monkeys and water buffalo). Multiple companies offering cloning technology have been established (e.g. RNL Bio of South Korea, US-based BioArts and Kheiron in Argentina) and cloning plays an important role in the animal-breeding industry. Cloned ponies have fetched up to \$800,000 at auction in Argentina, and in 2012, the Fédération Equestre Internationale lifted its ban on cloned horses participating in competitions. The first orders for commercial pet dog cloning were completed by RNL Bio and BioArts in 2008.



Cloned horses have been cleared to take part in races.



# CONSERVATION OF ANIMAL BREEDS

Cloning has been used to conserve several animal breeds in the recent past. For example in 2012 an increasingly rare Himalayan pashmina goat breed was successfully cloned. This important achievement, performed in the frame of the National Agricultural Innovation Project of the Indian Council of Agricultural Research, offers hope to the people of Kashmir of increasing production of pashmina, a type of cashmere wool. In Kashmir more than 10 million people are associated with an \$85 million shawl industry that depends on the availability of the exceptionally fine wool produced by these rare animals.



Cloning offers hope for pashmina goat farmers.



In 2008, the US Food and Drug Administration decided that meat produced from clones and their progeny is acceptable for human consumption. Similar conclusions have been drawn by the European Food Safety Authority. However, animal cloning for food production in Europe meets with considerable opposition; use of cloned animals is more accepted and widespread in Asia and the US.

Cloning from frozen somatic tissue is a more cost-effective strategy for bio-banking of endangered breeds than storage of sperm or egg cells. Sample collection and storage is easier and cheaper; the technique can be deployed quickly in emergency situations such as a disease outbreak; and cloning recovers all the genetic variation of the donor – not just half of it as when using sperm. SCNT cloning of farm animals is a common new service in some countries including the US, Argentina and Brazil and is covered by major veterinary genetics and animal biotechnology textbooks.

# NEW TECHNOLOGY FOR IMPROVING LIVESTOCK

SCNT cloning is the only technology available that enables generation of 99.8 per cent genetically identical offspring from selected individuals of adult animals (including sterilized animals). As such, it is an efficient multiplication tool to support specific breeding strategies of farm animals with exceptionally high genetic value.

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