

Animal Cloning in Food Production



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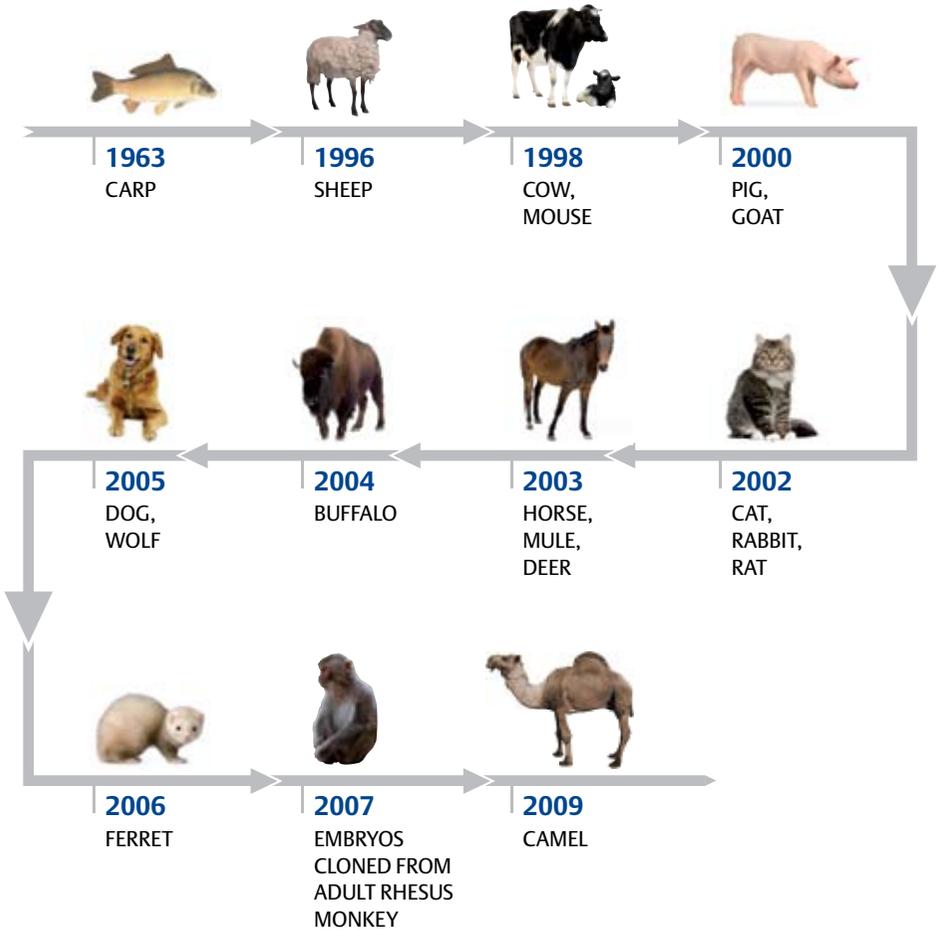
Animal cloning is an assisted reproduction technique whereby offspring inherit their genetic material (DNA) from a single parent rather than two, as is the case with conventional breeding. Similar to the use of grafts or cuttings to preserve and propagate desirable plant traits, animal cloning is a means of faithfully reproducing desirable animal breeds without the dilution or random inheritance of favourable characteristics that can occur during conventional breeding. Animal cloning is a rapidly evolving science that, along with commercial applications, has the potential to preserve endangered animal breeds and species, and possibly assist in the reintroduction of extinct species in the future.

The cloning of Asian carp in China in 1963 represents the first animal to be cloned, while a female sheep named Dolly, born in Scotland in July 1996, was the first mammal to be successfully cloned. Instead of the usual mating of a ewe and a ram, Dolly was the product of somatic cell nucleus transfer (SCNT), a particular form of cloning which has subsequently been used to reproduce a range of mammals including cows, goats, pigs, dogs, cats and camels, among others. Dolly was euthanised in 2003 due to a progressive form of lung cancer caused by a viral infection that is common in sheep.

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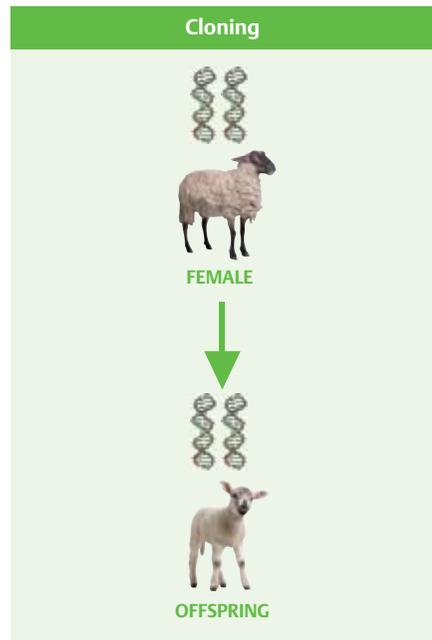
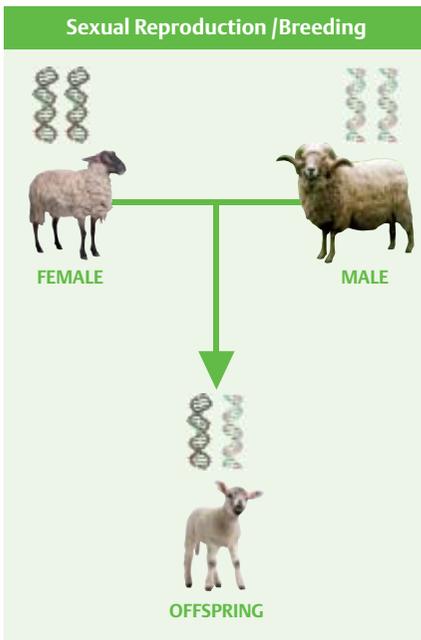
Advances in Animal Cloning



Sexual Reproduction (Breeding) versus Cloning

Humans have been selectively breeding animals for centuries in order to preserve, enhance or introduce desirable characteristics. The breeding of animals for food production, for use in sporting activities or as pets has become a sophisticated science over time, with techniques such as artificial insemination playing an important role. Though some of the animal breeds in existence today might have evolved without human intervention, selective breeding has been key in accelerating the process.

Animal breeding involves sexual reproduction where a female egg is fertilised by male sperm, resulting in an offspring with genetic material from both parents. In contrast, a cloned animal is the product of asexual reproduction, where the DNA from an adult cell is reprogrammed so that it behaves as if it belongs to a newly formed embryo, with the potential to function in a cell from any part of the body. The DNA in a cloned animal is inherited from a single parent. In the case of Dolly the sheep, the nucleus of a cell from the mammary gland (udder) of an adult female sheep (donor) was placed in an unfertilised egg, from which the nucleus had been removed. Following electrical stimulation,



the embryo was allowed to develop briefly under laboratory conditions and then placed in the womb of a surrogate mother (dam) to grow to a full term foetus. The resultant lamb contained genetic material from the donor sheep only.

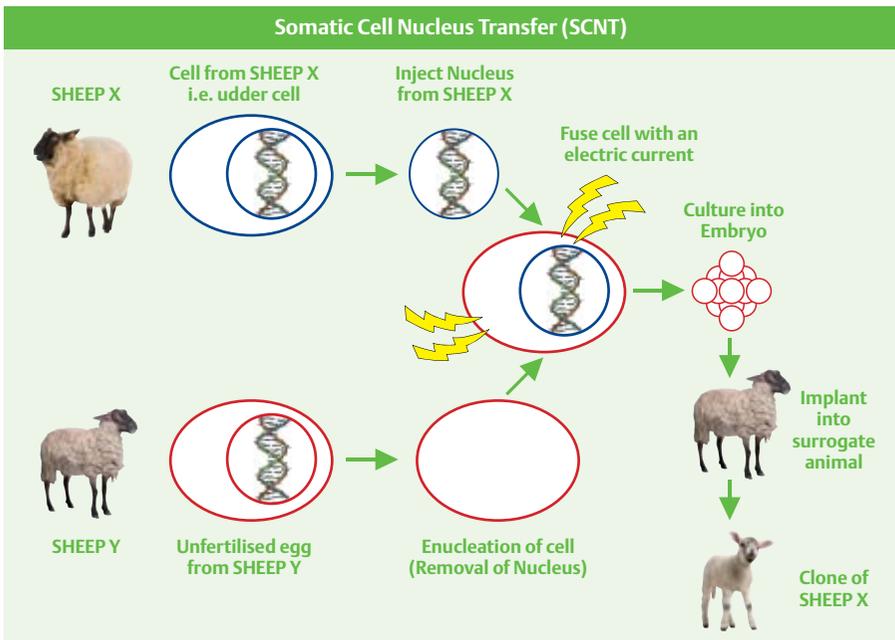
Identical Twins are not Clones

Identical twins are similar to clones in that they are genetically identical. However, they are not considered as clones since they have two parents and arise from the union of a single sperm and a single egg. The embryo splits early in its development, yielding two

embryos that normally grow into physically separate (except for conjoined twins), but genetically identical individuals.

Cloned Animals are not GMOs

A genetically modified organism (GMO) is defined as an organism whose genetic content (DNA) has been artificially altered by the addition, deletion or manipulation of one or a number of genes. The DNA of a cloned animal is not necessarily altered in any way, but is simply inherited from one rather than two parents.



Cloned Animals in Food Production

Animal clones or their offspring are not used for commercial food production in the EU at this time, though the situation in other countries around the world is not as clear. Due to cost implications and the low efficiency rate of animal cloning, it is likely that the offspring rather than the cloned animals themselves will be used to produce food. Animal cloning is viewed as a way of enhancing the stock quality of certain food producing animals and in the short to medium term is likely to include high milk-yielding cows as well as superior meat producing animals.

Safety of Food from Cloned Animals

Cloned animals can generally be used in conventional breeding programmes, and it is the offspring from such breeding that is likely to be used in food production in the future. Food derived from any animal in the EU is subject to regulatory constraints that ensure only healthy animals are used in the production of food. A report by the European Food Safety Authority (EFSA), published in 2008, examined the impact of animal cloning on food safety, animal health and welfare and the environment. Due to the limited data available, only the safety of food derived from cattle and pigs was evaluated using compositional and nutritional content, novel constituents, toxicity, allergenicity and the health status of the animals. EFSA concluded that while

the available data were limited and further research warranted, it is unlikely that there would be any additional risk associated with the consumption of milk or meat derived from healthy cloned animals, or their offspring, compared to that of their conventionally bred counterparts. This opinion was in general agreement with the conclusions of a similar assessment carried out by the US Food and Drug Administration on cattle, pigs and goats, also published in 2008.

EU Regulation of Food from Cloned Animals



Animal cloning is not specifically covered by any EU food safety legislation to date. A fundamental principle of EU food law, set out in Regulation (EC) No 178/2002, stipulates that; “Food shall not be placed on the market if it is unsafe”. In addition, animal cloning is considered a novel food production process in the EU, and therefore any food or ingredient from a cloned animal requires prior authorisation under the novel food Regulation (EC) No 258/97 before being placed on the EU market. A rigorous safety assessment is carried out by experts from one of the EU Member States, which is then reviewed by other Member States, and the Commission, before market authorisation is granted. The Novel Food Regulation is currently being revised and animal cloning may be specified in the revised legislation.

Other Issues

Ethics and animal welfare

The European Group on Ethics (EGE) in Science and New Technologies, an advisory body to the European Commission, published its opinion in 2008 on the “*Ethical Aspects of Animal Cloning for Food Supply*”. In its conclusions, the group doubted whether cloning animals for food production was ethically justified in light of apparent health and welfare issues associated with surrogate mothers and animal clones. If such animals were to be introduced to the EU market, the EGE recommended that certain criteria be met regarding food safety, public awareness, animal health and welfare and traceability. The basic principles guiding the protection of farm animals in the EU were adopted by the Council of Europe in 1976; “*European Convention on the Protection of Animals*”. EU legislation subsequently put in place includes Council Directive 98/58/EC that details minimum standards for animals kept or bred for farming purposes, and Council Directive 86/609/EEC which sets out the legal framework protecting animals used for experimental or other scientific purposes.

Research and development

A relatively small number of institutions within the EU are carrying out research on animal cloning. Research and development of animal cloning is also known to be ongoing in non-EU countries including the USA, Argentina, Australia, Brazil, Canada, Chile, China, Japan, New Zealand and

South Korea. While further commercial interest is anticipated in animal cloning as the technology evolves, current activities are largely restricted to research and development.

Useful Links

European Food Safety Authority (EFSA)

http://www.efsa.europa.eu/EFSA/efsa_locale-1178620753812_home.htm

Irish Legislation on Animal Health and Welfare

<http://www.agriculture.gov.ie/animalhealthwelfare/legislation/>

EU Legislation on Animal Protection

http://ec.europa.eu/food/animal/welfare/references_en.htm

European Group on Ethics in Science and New Technologies (EGE)

http://ec.europa.eu/european_group_ethics/index_en.htm

US Food and Drug Administration (FDA)

<http://www.fda.gov/>



Food Safety
AUTHORITY OF IRELAND

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on food production and
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