

## Cloning

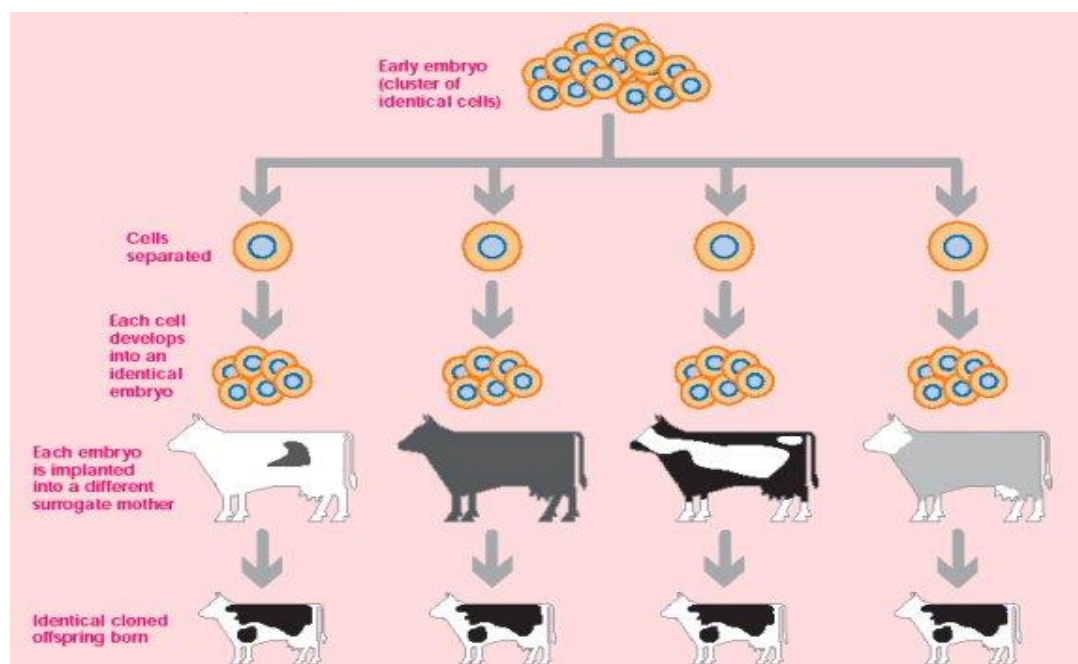
Cloning is the production of a copy or copies of an individual and occurs in animals either naturally or artificially, when an embryo is split to produce identical twins.

The word “clone” has also been used to describe animals produced by nuclear transfer for the production of an unlimited number of genetically identical offspring. The first successes in cloning livestock were with sheep, by fusing a cell from a 16-cell embryo to an oocyte that had its chromosomes removed (enucleated oocyte).

### *Advantages*

Among the possible advantages of cloning in cattle, the following have been mentioned in various reports:

- (i) herds with homogeneous production, nutritional and health characteristics optimal for a given local environment could be created;
- (ii) identical replacement animals could be generated for such herds and production costs could be markedly reduced;
- (iii) the preservation of genetic material could take the form of frozen tissue samples rather than cryopreserved gametes



## Natural cloning

Natural cloning is the production of clones without the involvement of genetic engineering techniques. It may occur accidentally in the case of identical twins, which are formed when a fertilized egg splits, creating two or more embryos that carry almost identical DNA. It may also be part of asexual reproduction, which is a process where a single parent organism produces genetically identical offspring by itself.

Cloning is a natural form of reproduction that has allowed life forms to spread for hundreds of millions of years. It is a reproduction method used by plants, fungi, and bacteria, and is also the way that [clonal colonies](#) reproduce themselves.

## Cloning stem cells

[Somatic-cell nuclear transfer](#), popularly known as SCNT, can also be used to create embryos for research or therapeutic purposes. The most likely purpose for this is to produce embryos for use in [stem cell research](#). This process is also called "research cloning" or "therapeutic cloning". The goal is not to create cloned human beings (called "reproductive cloning"), but rather to harvest stem cells that can be used to study human development and to potentially treat disease. While a clonal human blastocyst has been created, stem cell lines are yet to be isolated from a clonal source.

Therapeutic cloning is achieved by creating embryonic stem cells in the hopes of treating diseases such as diabetes and Alzheimer's. The process begins by removing the nucleus (containing the DNA) from an egg cell and inserting a nucleus from the adult cell to be cloned. In the case of someone with Alzheimer's disease, the nucleus from a skin cell of that patient is placed into an empty egg. The reprogrammed cell begins to develop into an embryo because the egg reacts with the transferred nucleus.

The embryo will become genetically identical to the patient. The embryo will then form a blastocyst which has the potential to form/become any cell in the body.

The process of cloning a particular farm animal using SCNT is relatively the same for all animals. The first step is to collect the somatic cells from the animal that will be cloned. The somatic cells could be used immediately or stored in the laboratory for later use.

The hardest part of SCNT is removing maternal DNA from an oocyte at metaphase II. Once this has been done, the somatic nucleus can be inserted into an egg cytoplasm. This creates a one-cell embryo. The grouped somatic cell and egg cytoplasm are then introduced to an electrical current. This energy will hopefully allow the cloned embryo to begin development. The successfully developed embryos are then placed in surrogate recipients, such as a cow or sheep in the case of farm animals.

SCNT is seen as a good method for producing agriculture animals for food consumption. It successfully cloned sheep, cattle, goats, and pigs. Another benefit is SCNT is seen as a solution to clone endangered species that are on the verge of going extinct. However, stresses placed on both the egg cell and the introduced nucleus can be enormous, which led to a high loss in resulting cells in early research. For example, [the cloned sheep Dolly](#) was born after 277 eggs were used for SCNT, which created 29 viable embryos. Only three of these embryos survived until birth, and only one survived to adulthood. As the procedure could not be automated, and had to be performed manually under a [microscope](#), SCNT was very resource intensive. The biochemistry involved in reprogramming the [differentiated](#) somatic cell nucleus and activating the recipient egg was also far from being well understood. However, by 2014 researchers were reporting cloning success rates of seven to eight out of ten and in 2016, a Korean Company Sooam Biotech was reported to be producing 500 cloned embryos per day.

