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# Biotechnology/Cloning poster

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# BIOTECHNOLOGY

## Cloning

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# What is Biotechnology?

- Biotechnology is the use of living systems and organisms to develop or make products, or "any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use. Depending on the tools and applications, it often overlaps with the (related) fields of bioengineering, biomedical engineering, bio manufacturing, molecular engineering, etc.
- For thousands of years, humankind has used biotechnology in agriculture, food production, and medicine. The term is largely believed to have been coined in 1919 by Hungarian engineer Károly Ereky. In the late 20th and early 21st centuries, biotechnology has expanded to include new and diverse sciences such as genomics, recombinant gene techniques, applied immunology, and development of pharmaceutical therapies and diagnostic tests.

# What is Cloning?

- The term cloning describes a number of different processes that can be used to produce genetically identical copies of a biological entity. The copied material, which has the same genetic makeup as the original, is referred to as a clone.
- Researchers have cloned a wide range of biological materials, including genes, cells, tissues and even entire organisms, such as a sheep.

# What are the types of artificial cloning?

There are three different types of artificial cloning: gene cloning, reproductive cloning and therapeutic cloning.

Gene cloning produces copies of genes or segments of DNA. Reproductive cloning produces copies of whole animals. Therapeutic cloning produces embryonic stem cells for experiments aimed at creating tissues to replace injured or diseased tissues.

Gene cloning, also known as DNA cloning, is a very different process from reproductive and therapeutic cloning. Reproductive and therapeutic cloning share many of the same techniques, but are done for different purposes.

# History of Cloning

- **1938 – the first idea of cloning:** Hans Spemann proposes a “fantastic experiment” – to replace the nucleus of an egg cell with the nucleus of another cell and to grow an embryo from such an egg;
- **1952 – an attempt to clone a *Rana pipiens* frog:** Robert Briggs and Thomas King; the scientists collect the nucleus from a frog egg cell with a pipette and replace it with the nucleus taken from a cell of a frog embryo; the experiment is not successful;
- **1970 – A *Xenopus laevis* frog:** John B. Gurdon is successful: he clones a frog, but its development only reaches the stage of tadpole. Despite attempts, he never manages to obtain an adult specimen. For many years, his achievement is questioned, especially in light of unsuccessful attempts to clone mammals;
- **1981 – Karl Illmenese and Peter Hope clone a mouse.** They take the nucleus not from an adult specimen, but from a mouse embryo;

- **1994 – Neal First tries to clone a sheep.** He takes the nucleus from an embryonic cell. He obtains a sheep embryo that develops 120 cells;
- **1995 – Two sheep are cloned** (Moran and Megan). These had been the first animals cloned from differentiated cells obtained by means of a pioneering method of nuclei transfer. However, the cells from which the nucleus was taken did not come directly from another living animal, but from a cell culture. The ones who achieved that were Ian Wilmut and Keith Campbell;
- **1996 – The first mammal cloned from a cell taken from an adult animal – Dolly the sheep.** Creators: Ian Wilmut and Keith Campbell;
- **1998 – the first cloned mouse** (it was called Cumulina);
- **2000 – the first cloned rhesus monkey;**
- **2000 – the first cloned pig** (or even five pigs);
- **2001- the first cloned buffalo and cow**

## **The first cloned cat (it was called CopyCat)**

- **2002** - Scientists Konrad Hochedlinger and Rudolf Jaenisch cloned **mice** from T lymphocytes.
- **2005- An Afghan hound**, Snuppy was cloned.
- **2007- A wolf cloned** - South Korean scientists obtained two female wolves.
- **2009-** The first animal from an **extinct species** was clones, the **Pyrenean Ibex**. The animal lived seven minutes, and then died from lung malformations.

# Future of Cloning

The legalities on human cloning differ around the world. In the U.S., human cloning is only explicitly outlawed in eight states. According to the Bioethics Defense Fund, an additional four states simply prohibit state funding of human cloning and 10 states allow human embryos to be cloned but ban the embryo from being allowed to mature full term (thus outlawing reproductive cloning but allowing therapeutic cloning). The international stance on cloning is clearer, with the United Nations General Assembly banning all forms of human cloning in 2005, including both reproductive and therapeutic.

For these legal reasons as well as ethical reasons, it's probable that the future of cloning will lie more in therapeutic cloning research than reproductive cloning. The only difference between therapeutic cloning and reproductive cloning is that in therapeutic cloning the embryo is never transferred into a female's womb. The current goals for therapeutic cloning are a means to

develop both patient and disease specific therapies for certain conditions. The procedure could also potentially use a patient's own cells for tissue replacement. Although the science is exciting, it will likely take many decades of research before scientists are able to create transplantable tissue.

# Conclusion

With the debate still on the table, it is undeniable that this radical jump in technology is extraordinary. It will extend people's life and prevent animals from extinction. It will even bring up animals from extinction. Having been around for a couple of decades already (Dolly the sheep was made in 1996), and whether we like it or not, cloning is a key to the future, and the future is now.

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