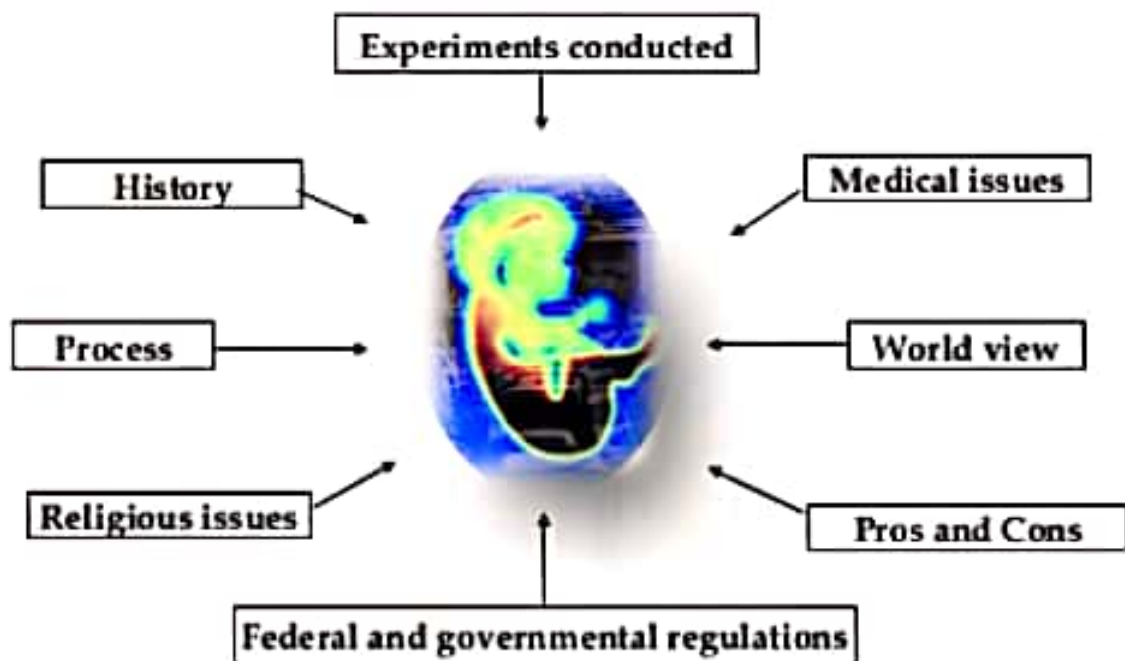


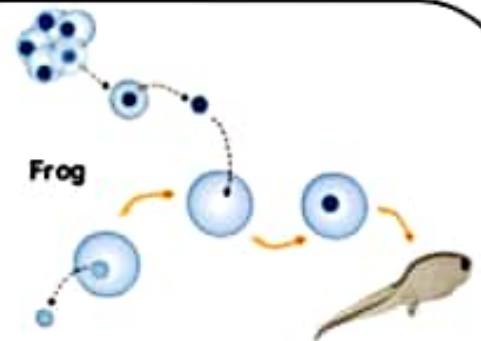
Cloning and Ethical Issues of Human Cloning



First successful nuclear transfer

Briggs and King transferred the nucleus from an early tadpole embryo into an enucleated frog egg (a frog egg from which the nucleus had been removed). The resulting cell developed into a tadpole

1952 - Most importantly, this experiment showed that nuclear transfer was a viable cloning technique. It also reinforced two earlier observations. First, the nucleus directs cell growth and, ultimately, an organism's development. Second, embryonic cells early in development are better for cloning than cells at later stages.

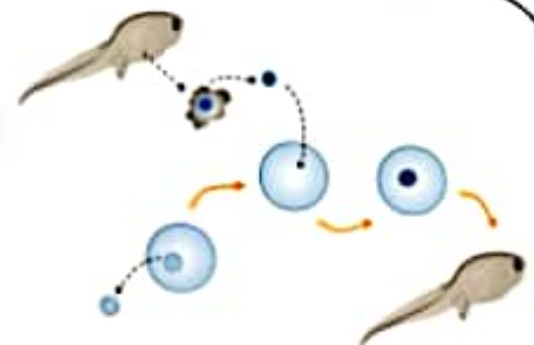


- Robert Briggs and Thomas King

Nuclear transfer from a differentiated cell

This experiment showed that, despite previous failures, nuclei from somatic cells in a fully developed animal could be used for cloning. Importantly, it suggested that cells retain all of their genetic material even as they divide and differentiate (although some wondered if the donor DNA came from a stem cell, which can differentiate into multiple types of cells).

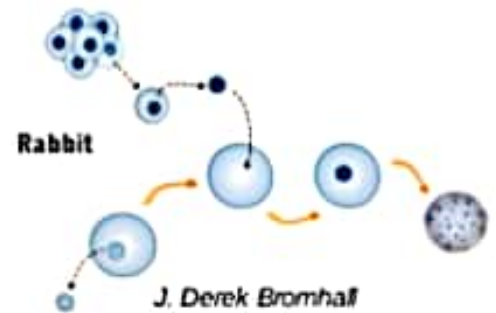
1958 -



John Gurdon

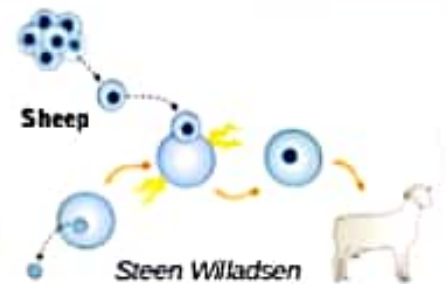
First mammalian embryo created by nuclear transfer

1975 - This experiment showed that mammalian embryos could be created by nuclear transfer. To show that the embryos could continue developing, Bromhall would have had to place them into a mother rabbit's womb. He never did this experiment.



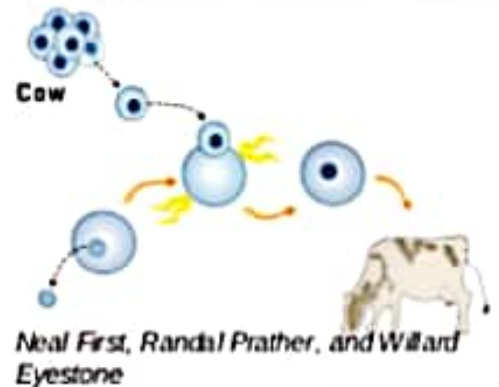
First mammal created by nuclear transfer

1984 - This experiment showed that it was possible to clone a mammal by nuclear transfer—and that the clone could fully develop. Even though the donor nuclei came from early embryonic cells, the experiment was considered a great success.



Nuclear transfer from embryonic cell

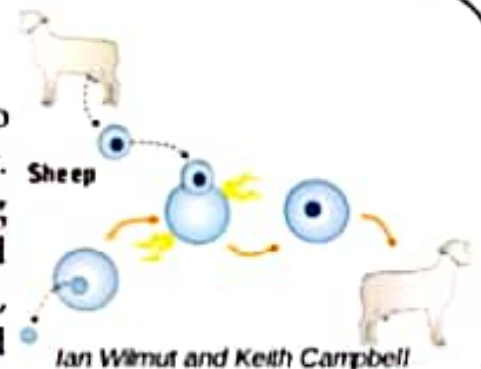
1987 - This experiment added cows to the list of mammals that could be cloned by nuclear transfer. Still, mammalian cloning was limited to using embryonic cells as nuclear donors. Cloning using nuclei from differentiated adult somatic cells still wasn't thought possible



Dolly: First mammal created by somatic cell nuclear transfer

1996-

Of 277 attempts, only one produced an embryo that was carried to term in a surrogate mother. This famous lamb, named Dolly, brought cloning into the limelight. Her arrival started conversations about the implications of cloning, bringing controversies over human cloning and stem cell research into the public eye.



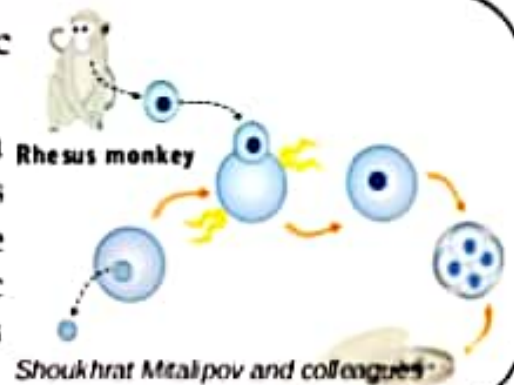
1998-1999 - More mammals cloned by somatic cell nuclear transfer

2001 - Endangered animals cloned by somatic cell nuclear transfer

Primate embryonic stem cells created by somatic cell nuclear transfer

2007 -

This experiment showed that nuclear transfer in a primate, which researchers had tried for years without success, was possible. It opened the door to the possibility of human therapeutic cloning: creating individual-specific stem cells that could be used to treat or study diseases.



Human embryonic stem cells created by somatic cell nuclear transfer

2013 - In this experiment, researchers took a skin cell from the patient and fused it with a donated egg cell. Key to the success of the experiment were modifications to the culture liquid in which the procedure was done and to the series of electrical pulses used to stimulate the egg to begin dividing.



Future of Human Cloning

No one truly knows the future of human cloning, but many believe models will be cloned to make designer babies. It is highly probable that a cloned human being lives among us now. You might read breaking headlines about cloning but most of those are a few years behind. Some say they just discovered a new process to human cloning in 2010, but in reality it was completed in 2005. In 2001, there was such a stir in the human cloning idea that hundreds of scientists did their work without anyone knowing. Thousands of dollars, eggs, adult cells etc. have been donated to human cloning research. As citizens of the world we cannot ignore scientific research, but instead regulate it. "Either we control gene technology today, or technology will redesign us by tomorrow."