

Animal and Human Cloning



Definition

Clone derived from Greek word Koln(twig) that is .process of **creating identical**

Human cloning is the creation of a **genetically identical** copy of a human. It **does not** refer to **the natural conception** and .delivery of **identical twins**



History

scientists and policy makers began to take the prospect seriously in the 1960s

Nobel Prize-winning geneticist)advocated (Joshua Lederberg: 1966 cloning and genetic engineering in an article in The American Naturalist .The Washington Post and in



He sparked a debate with conservative bioethicist Leon Kass, who: 1971 wrote at the time that "the programmed reproduction of man will, in fact, dehumanize him." James D. Watson, publicized the potential and the perils of cloning in his Atlantic Monthly essay, "Moving Toward the Clonal " .Man



cloning of a sheep known as Dolly by somatic cell nuclear transfer: 1996).(SCNT

The first hybrid human clone was created by : 1998 Advanced Cell Technology. It was created using SCNT - a nucleus was taken from a man's leg cell and inserted into a cow's egg from which the nucleus had been removed, and the hybrid cell was cultured, and developed into an embryo. The embryo was destroyed after 12 days



History

a professor at **Seoul National University**, **Hwang Woo-suk**: 2005, 2004
, published two separate articles in the journal *Science* claiming to have successfully harvested pluripotent, **embryonic stem cells** from a cloned human blastocyst using somatic-cell nuclear transfer techniques. Hwang claimed to have created eleven different patent-specific stem cell lines. This would have been the first major breakthrough in human cloning. However, in 2006 *Science* retracted both of his articles on clear evidence that much of his data from the experiments was fabricated



Dr. Andrew French and **Samuel Wood** of the biotechnology company **Stemagen** announced that they successfully created the first five mature human embryos using SCNT. The embryos were developed only to the blastocyst stage, at which point they were studied in processes that destroyed them



scientists at the New York Stem Cell Foundation announced that: 2011 they had succeeded in generating embryonic stem cell lines, but their process involved leaving the oocyte's nucleus in place, resulting in triploid cells, which would not be useful for cloning

History

a group of scientists led by Shoukhrat Mitalipov published the: 2013 first report of embryonic stem cells created using SCNT. In this experiment, the researchers developed a protocol for using SCNT in human cells, which differs slightly from the one used in other organisms. Four embryonic stem cell lines from human fetal somatic cells were derived from those blastocysts. All four lines were derived using oocytes from the same donor, ensuring that all mitochondrial DNA inherited was identical



a team led by Robert Lanza at Advanced Cell Technology: 2014 reported that they had replicated Mitalipov's results and further demonstrated the effectiveness by cloning adult cells using SCNT



Types

Therapeutic Cloning - 1

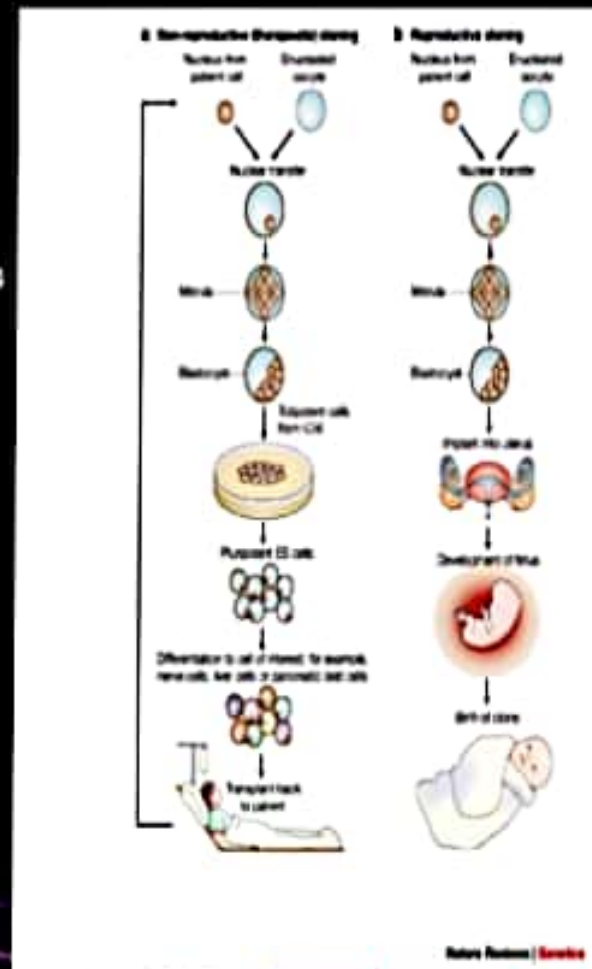
involve cloning cells from a human for use in medicine and transplants, and is an active area of research, but is not in medical practice anywhere in the world, as of 2014

Two common methods of therapeutic cloning are

-) Somatic cell nuclear transfer (SCNT)
-) Induced pluripotent stem cells (iPSCs)

Reproductive Cloning - 2

involve making an entire cloned human, instead of just specific cells or tissues



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graph TD; A[Methods] --> B[Somatic cell nuclear transfer (SCNT)]; A --> C[The Roslin Technique]; A --> D[The Honolulu Technique];
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Methods

**Somatic cell
nuclear transfer
(SCNT)**

**The Roslin
Technique**

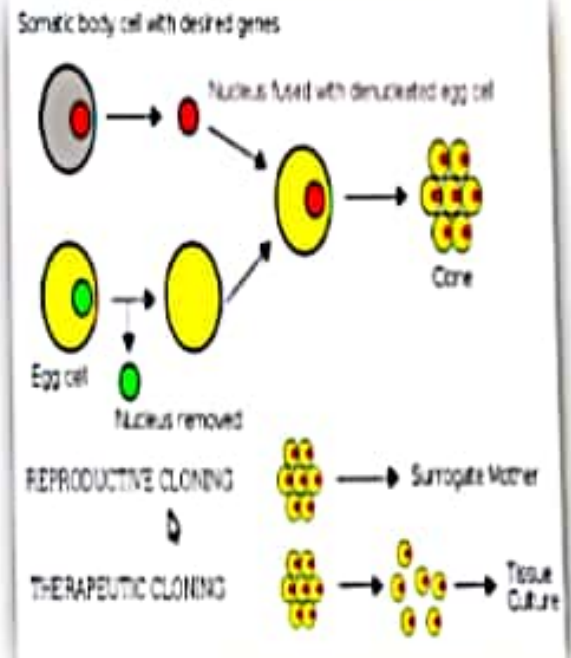
**The Honolulu
Technique**

Somatic cell nuclear transfer - 1 (SCNT)

The nucleus of a somatic cell is taken from a donor and transplanted into a host egg cell by micropipette, which had its own genetic material removed previously, making it an enucleated egg

The somatic cell genetic material is fused with the egg using an electric current

Once the two cells have fused, the new cell can be permitted to grow in a surrogate or artificially

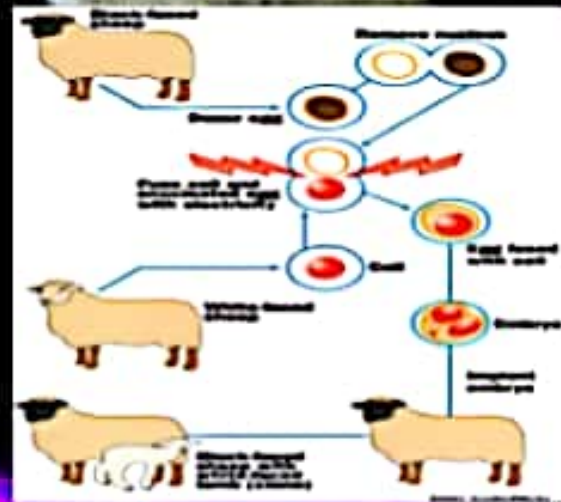


The Roslin Technique - 2

The nucleus of an egg cell is removed
(enucleated)

The enucleated egg cell and a somatic cell are
joined together by an electrical charge and
implanted into the host organism (in the case of
Dolly, it was a sheep)

The cell should act like a normal egg and grow
into a new organism, as a clone of the donor
animal



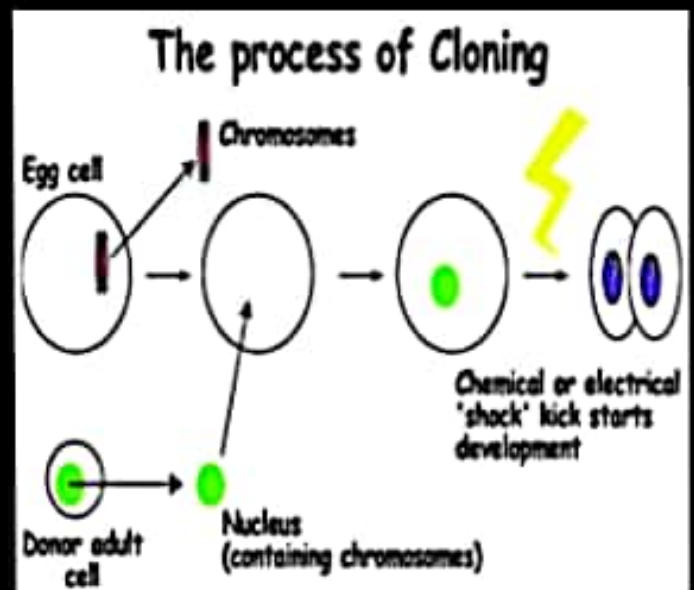
The Honolulu Technique – 3

The nucleus of a somatic cell is removed

The nucleus of an egg cell is removed

The Somatic cell's nucleus is implanted into the cytoplasm of the egg cell

The egg is then treated with special chemicals and implanted into the surrogate organism



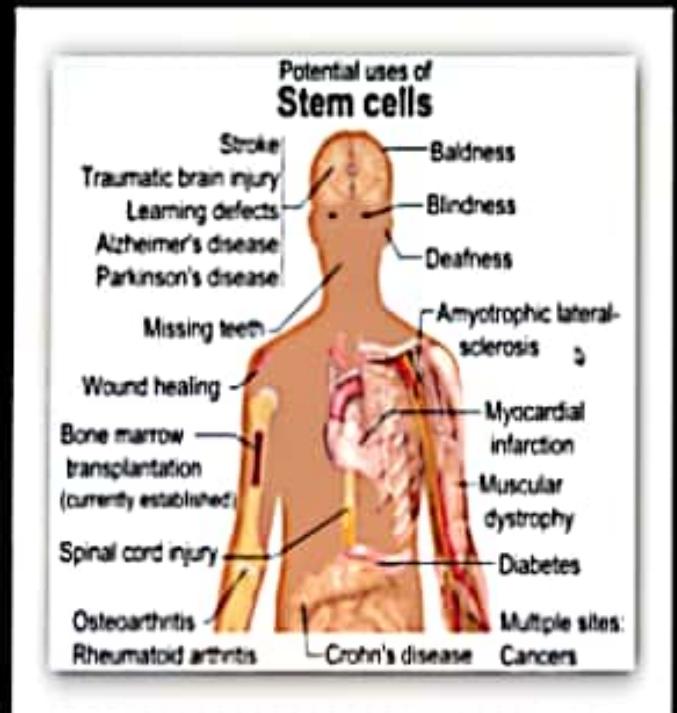
Uses, Actual and Potential

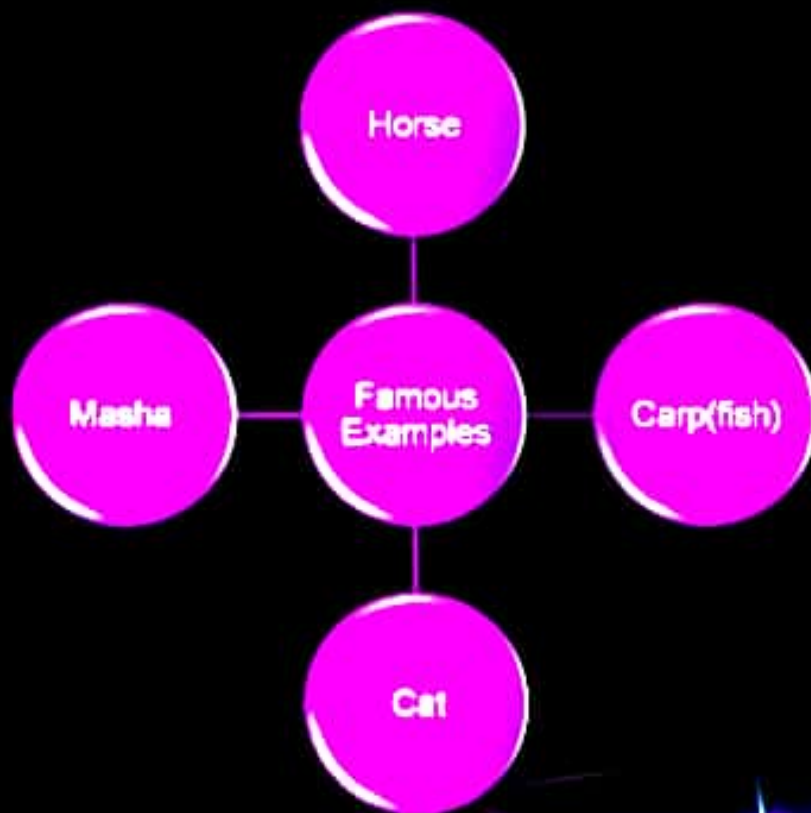
useful for research into the causes of disease, and as model systems used in drug discovery

used in stem cell therapy, or to create organs to be used in transplantation, known as regenerative medicine

Research is underway to potentially use stem cell therapy to treat heart disease, diabetes, and spinal cord injuries

In current research, human pluripotent stem cells have been promised as a reliable source for generating human neurons, showing the potential for regenerative medicine in brain and neural injuries





Ethical Implications

Therapeutic Cloning is the creation of an embryo to supply embryonic stem cells for medical use

The creation of a human embryonic stem cell line requires the destruction of an embryo

Some groups argue that embryos are not the equivalent of life, and only have the potential for life

Other groups argue that an embryo is a living being that is killed for stem cells



Ethical Implications

Scientists have found ways to get around the ethical issues associated with Embryonic Stem Cells

Pluripotency- the ability for a cell to differentiate into many different types of cells

The Induced Pluripotent Stem Cell is a stem cell that is derived from a non-pluripotent cell such as a typical adult somatic cell, which has been changed into a stem cell by forced gene expression

Because Induced Pluripotent Stem cells are derived from the somatic tissues of recipient patients, they overcome two major hurdles human embryonic stem cells have faced: immune rejection and the ethical concerns surrounding Embryonic Stem cells

