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Briefing prepared by Elliott Cannell MSc (Oxon), Nov 2004, for CORE, Comment on Reproductive Ethics followed by update, Dec 2007, by Josephine Quintavalle.

What do we mean by human cloning?

Human cloning is the production of a genetic copy of another human individual.

How are human clones produced?

Nuclear transfer - the nucleus of a mature egg cell is removed and replaced with the nucleus of a donor cell from an existing human being. The embryo created by this process will be the clone or twin of the donor of the nucleus.

Embryo splitting - the deliberate division of an early embryo into two or more genetically identical embryos. Embryo splitting can occur naturally (identical multiple births) but remains relatively rare. Surprisingly little is known about natural embryo splitting, suggesting that it should not be used as a model to justify cloning.

What is meant by 'reproductive' and 'therapeutic' cloning?

In **'reproductive' cloning** the developing embryo (produced by one of the above processes) would be allowed to continue growing as a copy of the donor from whom he or she was created. Reproductive cloning could be used in fertility treatment, to provide a copy of a person unable to reproduce naturally, or even to provide a living source of 'spare parts' for the donor. Tissue or bone marrow, for example, could be taken from the live clone, or vital organs such as heart or brain harvested.

In **'therapeutic' cloning** normal growth of the cloned embryo would not be allowed to continue past the stage (first days of life) when the embryonic cells were not yet fully differentiated. It is thought that these cells (embryonic stem cells) can be programmed to multiply to produce specific human tissue which could then be used in transplant therapies.

What is the difference between 'reproductive' and 'therapeutic' cloning?

There is absolutely no difference in the initial cloning procedure: a cloned human embryo has to be created in both cases. The difference lies exclusively in the destiny of the clone.

Have any diseases been cured using 'therapeutic' cloning?

No. Despite the mountain of scientific rhetoric, no patients or laboratory animals have ever been cured of any disease using 'therapeutic' cloning technology. And where animals have been cloned for full reproduction, the fatal abnormality rates have been extremely high, with only 3-4% of animals even making it to birth. A significant obstacle with 'therapeutic' cloning lies in our inability to control the development of embryonic stem cells (ESCs) themselves. When implanted into living hosts, ESCs typically develop into a broad range of different tissues, as well as the types of cell needed for repair. In many cases the implanted ESCs form cancerous tumours called teratomas. These are untreatable. Animals displaying teratomas are put down before they die of cancer.

The process of cloning adds further complications. Scientists now realise that donor nuclei usually fail to achieve complete reprogramming once inserted into enucleated eggs. This generates the genetic abnormalities we referred to, and may explain why implanted clones so often die during pregnancy. Stem cells taken from cloned human embryos are also highly likely to carry these abnormalities, and would be unsuitable for implantation into patients.

Could cloning provide treatments for everyone?

Many scientists argue that human cloning technology will enable doctors to create genetically matching donor material for each individual patient. However, to create human clones you need human eggs. We live in a world with a chronic shortage of donor eggs. Even if researchers were to overcome the many technological obstacles inherent in human cloning, they could never obtain enough donor eggs to treat more than a small fraction of their patients.

Alternative sources of stem cells

Embryonic stem cells certainly get a lot of media attention; not because they are providing any miracle cures, but because their use is so controversial. However, there are other sources from which stem cells can be harvested. These cells, commonly referred to as 'adult' stem cells, are currently being used to treat patients for a variety of serious diseases. Adult stem cells from the nasal cavity are used to improve coordination in patients with spinal cord injury, adult stem cells from umbilical cord blood can cure children of Sickle Cell Disease and beta thalassaemia, and adult stem cells from the spleen are being used in clinical trials to cure diabetes. Adult stem cells not only provide an ethical alternative to those derived from the destruction of embryos, but they can actually be used already to treat disease. **To date a total of 56 different serious conditions have been treated using adult stem cells. Embryo stem cells have not produced a single treatment** (as of the end of October 2004).

Has anyone ever produced a cloned baby?

Over the past 5 years several people have claimed to have created cloned babies. However, none of these individuals have been members of the scientific establishment and no story has ever been corroborated with scientific evidence. In many cases claimants have not even provided a photograph of a supposedly cloned baby, let alone produced a DNA test. Scientists investigating reproductive cloning in animals now say that cloning primates is especially problematic. Indeed, to date no one has ever produced a cloned ape, despite repeated attempts. This makes it even more unlikely that anyone has ever created cloned babies.

Is human cloning legal?

At present there is no international agreement on the legal status of human cloning. Despite gaining widespread support, a bill which sought to outlaw all forms of human cloning was recently abandoned by the United Nations. The initiative, launched by Costa Rica and supported by the United States and dozens of European and Latin American nations, had gained the backing of 62 nations. However, 22 nations formed a coalition to oppose the move and the bill was eventually blocked. Instead the UN has decided to issue a nonbinding declaration calling on individual countries to establish their own legislation banning human reproductive cloning. The measure, suggested by Italy, is expected to be completed by February 2005. In the meantime 'therapeutic' cloning will remain legal in some countries. These include the United Kingdom, France, Spain, Singapore, Sweden and South Korea.

More information

For more information contact:
Comment on Reproductive Ethics (CORE), PO Box 3459, London SW3. Tel: 020 7581 2623, fax: 020 7581 3868, e-mail: info@corethics.org, website: www.corethics.org

Since first producing this briefing sheet, CORE has continued to monitor carefully any developments in the field of human cloning. The good news is that there has been very little of substance to report, and any claims to have cloned human embryos need to be deconstructed very carefully.

The major claims – hailed as the breakthrough of the century – were attributed in 2004 to a South Korean scientist called Hwang Woo-suk, who not only was said to have successfully cloned human embryos but also later to have derived patient-specific stem cells from the alleged clones. For months the triumphs of Professor Hwang filled the media and were reported in prestigious scientific journals, only to be finally denounced as completely fraudulent.

At the University of Newcastle a team under a researcher called Miodrag Stojkovic was granted a human cloning licence around the same time as Hwang, and the team claimed a modest success in 2005, with one cloned embryo surviving for 5 days. Even this research has been questioned as it has never been replicated, and the cells used to create the embryos came from embryonic stem cell lines rather than adult tissue.

There has been some progress made in the cloning of monkey embryos, considered to be close to the human species, but without successful pregnancies. And that is about all there is to report on the human cloning front. Hardly a success story.

What does need to be reported, however, is that there has been huge progress in the past decade in the application of ethical adult stem cell therapies to human disease. Such stem cells are taken from the adult body or from umbilical cord blood and amniotic fluid at birth. No embryos are cloned or involved in anyway in such therapies. Anybody wishing to read more about these cures should check out the US website: www.stemcellresearch.org.

Remember that the reason for wishing to clone human embryos is in order to obtain patient-specific stem cells for therapeutic purposes. The most exciting development in stem cell therapy was reported in 2007, when it was revealed that a Japanese scientist, Professor Yamanaka, had developed patient-specific stem cells without cloning human embryos. He was able to achieve this using skin cells from the specific patient. The stem cells he has derived have properties similar to embryonic stem cells but do not involve human embryos.

This is indeed a remarkable and exciting development, and immediately the world's most significant stem cell scientists (Thomson, Lanza, Jaenisch, to name a few) spoke out in favour of the Yamanaka approach, in some cases even acknowledging that they were doing similar work themselves. Our own Professor Wilmut, responsible for the cloning of the first mammal, Dolly the Sheep, announced that he would be giving up on human cloning in order to pursue the new method.

Proposals in the new Bill before Parliament to permit the creation of interspecies embryos (using cloning techniques or regular fertilisation), combining animal and human sperm and eggs, must be opposed. Again the claim is that such horrifying research is necessary to develop patient-specific stem cell cures. The proposals are intrinsically abhorrent of course and we know that it is not right to create animal-human hybrids.

In light of the new developments in stem cell science we can argue cogently, however, that there is no scientific justification whatsoever for any form of human cloning.