Human cloning – what should we really be frightened of?

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Clin Med 2004;**4**:299–301

Humans reproduce sexually; naturally conceived children are a unique product of the union of their mother and father. The child is an individual, not a genetic replica of either parent. However, even in nature there are millions of human clones – we call them identical twins.

Monozygotic or identical twins occur naturally when a single fertilised egg divides into two physically separate, but genetically (almost) identical embryos. Monozygotic twins, having a very similar genetic make-up, are always the same sex, have the same blood type, and are very much like each other in appearance.

So exactly what is it in the idea of human cloning that we should be frightened of?

On the face of it, a cloned human is simply an identical twin separated by an unnatural time gap. A woman could in theory give birth to a child created by injecting the nucleus of one of her own body cells, say a skin cell, into one of her eggs, getting that egg to start dividing and implanting it into her uterus where it would grow to term and be born – the exact genetic replica of herself.

In the six years since the announcement of the first successful cloning of a mammal, Dolly the Sheep, there has been much ethical debate on this subject. This has intensified over the last year or so following the announcement by the Raelian movement in December last year that the first human cloned baby had been born and the announcement in January this year that Panos Zavos had implanted a cloned embryo. These announcements are viewed with widespread scepticism by the scientific community because of the lack of evidence to support their claims. But the reality is that there are people prepared to go down this road.

Why should that frighten us? The first reason is that many cloned animals have been born sick or deformed; in fact most animal cloning experiments end in miscarriage. A high proportion of cloned embryos simply fail to develop beyond the very early stages; the few that do often then fail to implant successfully in the uterus. The technique that produced Dolly the Sheep needed 277 attempts to achieve one success. Even when pregnancies are established, a much higher proportion of them than usual end in miscarriage. Of those which are carried to term many die soon after birth, having suffered from a range of very significant developmental problems. It simply is not responsible to do this in humans: we must consider the welfare of any child born using these experimental techniques.

Cloning can also put the birth mother at risk: a study in the USA using cows showed that four out of 12 surrogate mothers died from pregnancy complications. Furthermore, most scientists believe that human cloning would only succeed at a huge cost, with thousands of women going through difficult pregnancies ending in miscarriage or abortion:

> *There's one thing virtually every animal cloner agrees on: human cloning ought to be unthinkable.*[1]

It may even be impossible to clone humans. The central obstacle is that during the development of a cloned embryo, the genetic material which is parcelled up in the cell has to split in two. The daughter cells seem to end up with too much or too little DNA and cannot survive. Last year in the journal *Science*, researchers at Pittsburgh School of Medicine reported their work to try to clone a macaque monkey. Despite hundreds of attempts they were unable to establish a single pregnancy.

Here lies the second reason that we should be frightened of cloning: it gives people who are desperate for children false hope and detracts from the real science being done within an ethical framework in the UK to try to find a treatment for people who cannot produce their own viable gametes. It is possible that cloning is dead-end science and will never be the answer to the quest to find a way for men and women who do not produce viable gametes to have their own genetic children.

But suppose human cloning could be done safely, what of the ethical questions? Is it 'playing God'?

In Aldous Huxley's seminal novel, *Brave new world*, natural human procreation becomes a thing of the past; instead babies are produced in identical batches:

> *One egg, one embryo, one adult-normality. But a bokanovskified egg will bud, will proliferate, will divide. From eight to ninety-six buds, and every bud will grow into a perfectly formed embryo, and every embryo into a full-sized adult. Making ninety-six human beings grow where only one grew before. Progress.*

Was this a work of fiction or a prescient warning of where science could take us? Some people believe human cloning could be used to produce an underclass of slaves, automatons – beings incapable of exercising their own judgement, willing to act according to the wishes and whims of evil influencers. But even though the genetic material in the child is the same as that in the parent, their life experience will be different and we know that nurture has just as important a role to play as nature in the shaping of someone's personality. So why do people feel so strongly about cloning?

In reply to our own Human Fertilisation and Embryology Authority (HFEA) consultation, 80% of people agreed that the creation of a clone of a human person would be ethically unacceptable. A central moral principle was that human beings should never be treated merely as a means to an end. People were worried that clones would have different expectations thrust upon them compared to naturally conceived children. Would it be possible to let clones grow up without comparing them to their older twin? Would clones have as free a choice about their lives or would people have preconceived ideas about their traits?

The other fear people have is that cloned embryos would be used for spare part surgery or to produce material to treat illness in their living cloned relative.

In this country, Parliament has reflected the view of society that reproductive cloning is ethically unacceptable. Reproductive cloning is illegal in the UK. The Human Reproductive Cloning Act 2001 prohibits the replacing of an embryo created otherwise than by fertilisation in a woman. A person found to be guilty of the offence is liable to be punished by up to ten years in jail.

But is all cloning bad?

There are other important reasons why we might wish to clone humans, which have nothing to do with making babies. In 1998 James Thomson and colleagues at the University of Wisconsin in the USA announced that they could isolate stem cells from human embryos.

Stem cells are undifferentiated – or 'unspecialised' – cells which can replicate themselves or can differentiate along pathways that lead to the formation of more mature cell types, ie become specialised cells. Stem cells have also been isolated from umbilical cord blood as well as from adult cells. However, embryonic stem cells are pluripotent, which means they have the potential to develop into any part of an eventual organism. It is hoped that eventually embryonic stem cells will be used to repair or replace damaged tissues in serious conditions such as heart disease, Parkinson's disease or diabetes.

To date, scientists have attempted to derive such cells mainly using embryos created for *in vitro* fertilisation (IVF) that were surplus to a couple's treatment and have been donated for use in such research. This is controversial because some people believe that human embryos should not be used for research even if they are not going to be used for IVF treatment.

The regulation of research on human embryos is governed by the Human Fertilisation and Embryology Act 1990. The purposes permitted were research into abnormalities of the early embryo, infertility, congenital disease, miscarriage and contraception. In September 1999, the UK Government set up an expert group, under the chairmanship of the Chief Medical Officer, Professor Sir Liam Donaldson, to undertake an assessment of the benefits of new areas of research using human embryos. In the light of the expert group's report, the Government brought forward draft regulations extending the purposes for which research on human embryos could be lawfully undertaken. In January 2001, with large majorities in both Houses of Parliament by free votes, the Human Fertilisation and Embryology (Research Purposes) Regulations were passed which added three new purposes for which research on human embryos are permitted:

- to increase knowledge about the development of embryos
- to increase knowledge about serious disease
- to enable any such knowledge to be applied in developing treatments for serious disease.

The UK Government encourages research on both embryonic stem cells and adult stem cells to ensure maximum medical benefit.

It is a requirement that a proportion of all stem cell lines derived from embryos be placed in the MRC Stem Cell Bank. From there they may be distributed to legitimate researchers. This will avoid the need for multiple laboratories to derive their own stem cells and will enable the HFEA to monitor the initial derivation of any human embryonic stem cell lines being produced. Thus, it will be possible to ascertain the need for continued derivation of new lines and therefore ensure that there is no unnecessary use of human embryos.

The use of surplus embryos, donated to research, is not the only source of embryos that could be used to derive stem cells. The technique used to create Dolly the Sheep, cell nuclear replacement (CNR), could be used to create or clone an embryo. CNR is the process of inserting the nucleus of an adult cell into a donated egg from which the original nucleus has been removed. Following CNR the recipient egg would be induced to divide to create an embryo. This is referred to as therapeutic cloning.

Embryonic stem cells have great potential due to their ability to reproduce themselves, and to differentiate into other cell types. They offer the prospect of developing cell-based treatments both to repair or replace tissues damaged by fractures, burns and other injuries and to treat a wide range of degenerative diseases. However, using embryonic stem cells therapeutically may be problematic in that transplanted stem cells may be rejected by the recipient's immune system. This is because the embryonic stem cells will not have been derived from the patient's own genetic material. It would be safer to treat patients with embryonic stem cells that are genetically identical to the recipient so that there is less chance of their immune system rejecting them. Theoretically, a cell taken from the prospective recipient patient could be used to create or clone an embryo from which stem cells could be derived. These cells would have the same genetic make-up as the

recipient and so prevent problems of tissue rejection. In effect the recipient would become their own tissue donor. It is a simple idea but hundreds of thousands of lives stand to be improved by it.

There is a danger that in rejecting reproductive cloning – cloning to produce identical human being – societies will also dismiss therapeutic cloning. Therapeutic cloning does not involve creating an identical human being but developing genetically matched stem cell lines from which perfectly matched tissue transplants (heart, skin and nerve cells etc) can be grown. This would not lead to cloned human beings but could provide, with minimal chances of rejection, cell transplants offering potentially very great advances in medical treatment for people with otherwise incurable degenerative diseases.

Kant famously ascribed three characteristics to human dignity: autonomy, identity or singularity, and freedom. All three would be undermined by reproductive cloning, while therapeutic cloning might enhance them. Reproductive cloning is a hubris which knows no limits and should be banned internationally. Therapeutic cloning is potentially life protecting and enhancing and should be supported.

Reference

1 Cohen P, Concar D. The awful truth. Why would anyone in their right mind want to clone a baby when animal cloning can go disastrously wrong? *New Sci* 2001;**170**:14–5.