The ethics of cloning

Julian Savulescu

Methods of cloning

The genome of a cloned cell is a near-identical copy of that of its parent or 'progenitor' cell. There are two methods of genome cloning – fission and fusion.

Cloning by fission

Blastocyst division – twinning is induced in an early embryo (blastocyst) by the application of heat or mechanical stress. The blastocyst splits in two, and the two halves continue to grow into complete embryos. At most, two identical embryos can be created using this method.

Blastomere separation – the coating of the blastocyst is removed and the cells (blastomeres) are placed in a solution that separates them. Each of these blastomeres is undifferentiated and can grow into an embryo. This technique can produce eight embryos at most, but can be repeated with each new embryo to produce a larger number of cloned embryos.

Cloning by fusion: fusion is achieved through the process of somatic cell nuclear transfer (SCNT). The nucleus is removed from a somatic cell and implanted into the cytoplasm of a denucleated egg. The egg reprogrammes the somatic cell's DNA so that a complete embryo can be grown from this cell. Using this technique, a theoretically endless number of clones can be created from the same individual. SCNT is the only method currently available that might be used to clone existing or pre-existing people.

Therapeutic and reproductive cloning

Cloning can be divided into therapeutic and reproductive.

Therapeutic cloning involves using cloning processes to produce embryonic stem cells, tissues or whole organs for transplantation. The main ethical issues associated with therapeutic cloning are those relating to the creation and destruction of embryos, and whether refining the cloning technique will create a 'slippery slope' from therapeutic to reproductive cloning.[1]

Reproductive cloning is the use of cloning to grow a living person who shares the DNA of the progenitor. Live animals have been cloned using fission (in the cattle industry) and SCNT (e.g. Dolly the sheep). There are currently no confirmed cases of deliberate cloning of a human embryo that was allowed to grow into a live baby. However, many countries (e.g. the UK, Australia) have enacted laws banning cloning, and several international declarations prohibit it (Figure 1).

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Cloning: the case against

Safety

A major objection to cloning (both therapeutic and reproductive) by SCNT is that it is currently an inefficient and unsafe procedure. The evidence from animal clones is that SCNT carries an increased risk of serious genetic malformation, malignancy and reduced longevity.

Fission methods seem to be less risky than fusion and, given that we allow women to proceed with very large natural multiple pregnancies, the risks should not be considered great enough to prohibit cloning by fission on the basis of safety.

Affront to human dignity

A prominent objection in international declarations against cloning is that it would be an 'affront to human dignity'. About 1/300 live births is of identical twins (or clones), however, and this does not seem to represent any threat to human dignity.

The US President's Council on Bioethics appears to define human dignity in reproduction as the acceptance of a child whose genome is 'mysterious' in origin: 'Parents beget a child who enters the world exactly as they did – as an unmade gift, not as a product. Children born of this process stand equally beside their progenitors as fellow human beings, not beneath them as made objects'.[2]

In the UK, the Nuffield Council on Bioethics stated that parents should express 'natural humility' in accepting the child that they are given.[3] However, we use many prenatal and pre-implantation genetic tests to evaluate fetuses and embryos for genetic abnormalities, and on their basis embryos and fetuses are destroyed. 'Natural humility' seems to have been rejected long ago.

International declarations on cloning

UNESCO universal declaration on the human genome and human rights (1997)
Art. 11: 'practices which are contrary to human dignity, such as reproductive cloning of human beings, shall not be permitted'

Additional protocol to the Council of Europe Convention on Human Rights and Biomedicine (1998)
www.conventions.cow.int/treaty/en/treaties/html/168.htm
Preamble: 'that the instrumentalisation of human beings through the deliberate creation of genetically identical human beings is contrary to human dignity and thus constitutes a misuse of biology and medicine'
Art.1: 'Any intervention seeking to create a human being genetically identical to another human being, whether living or dead, is prohibited'

Charter of fundamental rights of the European Union (2000)
www.europarl.eu.int/charter/default_en.htm
Art. 3 urges 'the prohibition of the reproductive cloning of human beings'

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Eugenics

It is widely argued that human cloning allows a form of eugenics in which people with desirable genetic traits are cloned, forcing these traits to persist while others decline. The eugenics practised by the Nazis in World War II was an atrocity, partly because it was based on beliefs about genetic determinism that were false, partly because it was motivated by racism, but mainly because it was not consensual. Eugenics via the implantation of genetically desirable sperm from Nobel laureates was available in the form of the 'Nobel sperm bank', but failed to achieve any relevance or popularity. There is no reason to think that cloning would be any more likely to be used for unethical eugenics than existing technologies such as contraception, sterilization and abortion.

Despite the stigma surrounding eugenics, its basic premise is true – some genomes are better than others. A gene sequence that causes a person to die during infancy, or to express uncontrollable violence towards others, reduces that person's quality of life. Arguably, we are obliged to try to have children with the longest and highest-quality life that we can give them.[4]

Instrumentalization

The philosopher Immanuel Kant said we should always treat people as an end, rather than exclusively as a means to an end. It might be thought that cloning for medical reasons (e.g. to produce bone marrow donors) would constitute treating the clone as a mere means. However, children are almost always at least partly a means to their parents' ends. Parents may have a child to repair their relationship, to be a sibling to their first child, to help them with the family business, to look after them in their old age, for company, or to conform to social norms (e.g. views against contraception). We allow parents to do this because we assume that they will love their children for the people that they are.

An example is the case of Marissa Ayala, who was conceived by natural reproduction to obtain compatible stem cells for treatment of her sister Anissa's leukaemia. A later report noted: 'Marissa is now a healthy four year old, and, by all accounts, as loved and cherished as her parents said she would be'. Marissa was certainly a means to Anissa's health, but she was treated as an end by her parents. Nobody was harmed.[5]

Living in the shadow

Another objection to reproductive cloning of an adult is that the clone would be worse off because it would be expected to express traits and abilities similar to those of its progenitor. However, the children of famous and successful people are not generally harmed by expectations about their abilities. Indeed, a clone may benefit from knowledge of his genetic inheritance – of his talents, limitations and disease propensities. A clone who knew that he was predisposed to heart disease or type 2 diabetes could plan his diet accordingly. The increased ability of clones to plan their life might be conducive to a less frustrated and more fulfilled life.

Reduced diversity

Sometimes, it is argued that genetic diversity would be reduced by widespread use of cloning. Natural twinning occurs at a rate of 3.5/1000 children and does not seriously impact on genetic diversity. None of the proposed reasons for making clones of human beings should lead us to believe that the prevalence of cloning will vastly exceed this natural rate.

Another popular argument is that the individuality of clones would be reduced. The European Parliament claimed that cloning would violate a clone's 'right to his or her own genetic identity'. However, we do not object to artificial increases in the prevalence of twinning through fertility treatment, nor do we pursue research into the prevention of natural twinning. Therefore, it cannot be true that we think that it reduces our individuality to have a non-unique genome. Twins have unique identities. Clones would be no different.

Cloning: the case in favour

There are strong reasons for pursuing research into the cloning of early embryos for therapeutic purposes. Some types of disease and injury (e.g. Parkinson's disease, spinal damage) have no potential therapies other than those involving embryonic stem cells. Cloning of embryos allows bulk creation of embryonic stem cells without the need to create millions of new embryos. Such cells and tissue would be immunocompatible with the donor. Cloning of embryos also provides opportunities to extend our scientific knowledge of human cells and tissues, ageing and many other cellular processes.

There are also good reasons to allow reproductive cloning in certain circumstances, if it were safe. Clones could be created as a compatible source of protein, cells, tissue or organs. This is already occurring naturally, and in a few cases using *in vitro* fertilization to identify compatible embryos ('saviour siblings').[5] Cloning would ensure the best possible genetic tissue match for donation, though it would not be useful in treating genetic conditions such as thalassaemia.

Reproductive cloning also offers a medical therapy for infertile couples. By cloning one parent, the couple could have a child who was genetically related to one of them. For infertile couples with limited numbers of eggs, SCNT could be used to vastly increase the numbers of embryos available for transfer.

It may be the case that couples undergoing assisted reproduction would benefit from choosing between cloned and sexually produced embryos. Genetic tests could be used to identify the embryo with the prospect of the longest and healthiest life. Such an embryo might be a cloned rather than a sexually produced embryo.

The future

The author believes that the medical and scientific benefits of research into therapeutic cloning are so great that this research is morally required. There is an overwhelming argument against reproductive cloning at present – it is unacceptably risky. However, when cloning becomes as safe as other reproductive methods, the arguments against it are weak. Because there are appreciable benefits to reproductive cloning, we should facilitate research that will improve its safety. Ultimately, there may be situations that morally require the creation of a live human clone. ◆

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Assisted reproduction

John McMillan

There is nothing new in departing from the traditional method of having children. Surrogacy, sex selection and assisted insemination have all been practised, or at least attempted, throughout history. However, widespread introduction of new reproductive technologies means that there are now many more ways to have a family and that these are becoming increasingly common.

A wide range of assisted reproductive techniques are currently offered in the UK. They range from the relatively simple assisted insemination to more 'high-tech' interventions such as pre-implantation genetic diagnosis (PGD). These interventions raise complex ethical issues (Figure 1). This contribution outlines one of the central legislative issues and shows how this has interesting implications for what we should think about so-called 'saviour siblings'.

The legislative framework

In 1978, Louise Brown, the first baby conceived by *in vitro* fertilization, was born. As a result of the ethical concerns that this development raised, the UK government established a committee of inquiry chaired by Mary Warnock. In 1984, the committee published the *Report of the Committee of Inquiry into Human Fertilisation and Embryology*, known as the 'Warnock Report', which was influential on the legislative framework that now governs reproductive technologies in the UK.

The crucial recommendations of the Warnock committee concerned the need for a legislative framework to govern provision of assisted reproductive technologies in the UK. These recommendations were adopted in the Human Fertilisation and Embryology Act (1990). This Act established the Human Fertilisation and

What's new ?

- The combination of HLA typing and pre-implantation genetic diagnosis has raised the question of whether it is acceptable to create saviour siblings

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