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What is Cloning?

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Abstract

Cloning falls within the narrower field of genetic engineering, and under the term clone is considered any organism created by asexual reproduction, that is, a body that has identical genetic material with the entity whose copy is, and any asexual propagation is cloning. Cloning is the simplest form of reproduction or duplication of genetic material, and is the only form of reproduction in single-celled organisms. It is also present in some plants, but also in animals. At the cellular level it is present in all living organisms, because this process multiplies all the individual cells of the living organism.

Keywords: Cloning; Technology; Dolly; Humans

Introduction

Cloning technology was invented during the twentieth century and now is poised to help define the twenty-first [1]. Almost everyone has heard of Dolly, the cloned sheep born in 1996 but what about the rapid progress made since then? Scientists now count horses, cows, cats, and dogs among the many animals they can clone. This progress raises a host of questions. Are you comfortable drinking milk or eating meat from a cloned cow? Should we clone extinct or endangered species? Will the April 2005 birth of Snuppy, the world's first cloned dog, usher in a new era of cloned pets? Should we clone embryos to generate embryonic stem cells and help develop medical therapies? And perhaps the most important question of all: when, if ever, will this progress lead to the first cloned human?

Although scientists are nearly unified in their opposition to cloning humans for reproductive purposes, on-going research toward other goals makes this likely, if not inevitable. For the most part, this research is driven by the hope that cloning technology will have significant health benefits, perhaps leading to transplantation therapies that use embryonic stem cells specifically tailored to individual patients.

As modern biotechnology is increasingly applied to humans, it raises important questions for society to address. Should we, perhaps in the relatively near future, allow infertile couples or single mothers to use cloning technology to try to produce a child? Should we, in the longer term, permit parents to use cloning technology not just to have children, but to have children with specific genetic modifications or enhancements? And understanding this general technique and its consequences is more than enough to participate fully in these important debates and to see through the many myths clouding discussions of cloning.

Cloning technology

The word "clone" is derived from the Greek word for twig [2]. Clonal reproduction is routine for dozens of domesticated plants, such as potatoes, and is common in nature as well, e.g., groves of aspen trees. For practical purposes, identical multiplets are the "gold standard" of the maximum degree achievable of phenotypic identity of mammals. None of the methods of cloning will achieve greater identity, and cloning by nuclear transplantation/cell fusion results in considerably less identity.

Cloning is, at its most basic level, reproduction without sex [1]. All humans alive today were born through sexual reproduction; a single sperm from the male joined with an egg from the female, creating an embryo with half its genetic material derived from each parent. Such offspring are the products of "asexual" reproduction.

If development proceeds normally, the resulting organism will be genetically identical to the single donor. In this case, reproduction no longer generates new combinations of genetic material but faithfully duplicates previously existing ones.

Scientists speculate that a cloned human and his or her parent would typically be less similar than identical twins. This is because the environment plays an important role in development.

Cloning involves various techniques. One such technique is" embryo splitting" [3]. This is the replication of the process that occurs naturally leading to the production of twins. Embryonic cells are separated at a very early stage before they have had a chance to differentiate. Another cloning technique is that of "nuclear substitution", which consists in replacing the nucleus of an embryo or unfertilised egg with a nucleus taken from another. Cloning may also involve 'cell nuclear replacement' (the technique used to create Dolly), namely replacing the nucleus of one cell with that of another cell and electrically stimulating development. Cloning may be undertaken for therapeutic purposes, such as tissue and organ replacement; or for reproductive purposes, that is, the creation of a new human being.

Clones are genetically identical individuals which arise through asexual or vegetative reproduction [4]. If this slipping process is only partially completed, such that some cells

remain within the zona, they can develop separately and independently parallel to the "main" embryo. The frequency of twin births is one in eighty five, and one in ten twin births leads to identical twins.

Cloning of humans

When Dolly was first introduced to the world, she opened the door to the potential cloning of humans yet few were truly interested in taking this step [1]. Although some publicity-seekers claimed to be cloning humans, the vast majority of scientists denounced the practice. This debate was changed forever by the successful isolation of human embryonic stem cells in 1998. Following this breakthrough, most scientists continue to denounce the cloning of humans for reproductive purposes but many embrace the concept of therapeutic cloning – the creation of cloned human embryos for the purpose of deriving human embryonic stem cell lines. The hope that this still-hypothetical possibility inspires is one of the driving forces behind the furor over human embryonic stem cell research in the United States and around the world.

In the, still-theoretical, therapeutic cloning process, an adult human cell is used as a donor for cloning and the resulting cloned human embryo is allowed to develop until the blastocyst stage, when human embryonic stem cells are isolated. These cells can develop into any of the many types of human cells and this unique ability gives them significant therapeutic potential. Furthermore, because the cells are genetically identical to the patient, the risk of immune rejection following transplant is greatly reduced, if not entirely eliminated. This combination of benefits has doctors, scientists, and patient advocates excited about the long-term potential of human embryonic stem cells and therapeutic cloning. The research is controversial, however, because it involves the deliberate creation of a human embryo, which after the isolation of embryonic stem cells is typically no longer viable.

Intellectual property

The future of any new technology is uncertain and cloning, for a variety of reasons, faces a particularly precarious road [1]. This situation results at least in part from the ethical controversy cloning engenders. Because politicians in different countries, and even different states within the same country, have reached different conclusions in the ethical debate, policies governing cloning research vary dramatically. These disparate policies may shape the field in unexpected and unusual ways.

Commercial uses of cloning technology also face an uncertain intellectual property environment. Numerous patents, owned by private companies and a bevy of academic scientists, cover various elements of the nuclear transfer technique and the derivation of human embryonic stem cells. How these patents are sorted out by various courts, and which are upheld or rejected in countries around the world, will influence the development of cloning technology, including the commercialization of cloned animals and the development of medical therapies based on therapeutic cloning.

An important and largely unanswered question is what impact these uncertainties are having on the development of cloning science. Some have claimed that the unusual regulatory patchwork governing therapeutic cloning and human embryonic stem cell research, in which neighboring countries may espouse diametrically opposed policies, is hindering their development. This may be because restrictions slow scientific progress in countries with large research communities. It may also be because policy differences lead to wasted energy and money, as policymakers work to lure scientists from one country to another and scientists find their research delayed as they close one laboratory and open another. These same dynamics apply to private companies that relocate in search of favorable policy environments or permissive intellectual property regimes.

Cloning is wrong?

After the birth of the first ever cloned mammal, Dolly the sheep, made the headlines, people all around the world rushed to condemn human cloning as an absolute wrong [5]. A number of laws and treaties were also quickly drafted in this spirit. Subsequent discussions in public, political, and academic fora echoed the denunciation of human cloning, although people were finding it difficult to put their fingers on the exact features that made cloning an absolute wrong. At the same time, however, there were voices excited about the possibilities that cloning humans might create.

By employing philosophical methods and arguments, it seems to be impossible to say that there is something absolutely, or per se, wrong about human reproductive cloning, although it includes practices that are wrong . By showing in which circumstances cloning is more wrong than in others, these practices are further specified. It is also recognized that the weakness of the arguments in favor of human cloning, and the wrongs (albeit contingent) related to the practice should lead us to conclude that there are no good reasons for investing public money or effort in human reproductive cloning. But we should also conclude that we do not have sufficient reasons to ban human reproductive cloning altogether, if the outstanding safety issues can be properly addressed.

The victory by supporting embryo research, won in 1990, resulted in a period of peace on that particular battlefield [6]. Controversy about the reproductive technologies focused more on emerging developments in fertility treatment, such as the fierce disputes about post menopausal motherhood and PGD (Pre-implantation Genetic Diagnosis). The truce was not to last. the advent of cell nuclear replacement (CNR) '… invigorated the opposition of those who have a principled objection to any form of embryo research'. Dolly, the 'miracle sheep', earned her place in human history in leading the way to mammalian, and potentially, human cloning. CNR involves the insertion of the nucleus of an adult cell into an emptied egg cell. The egg cell is then subjected to an electrical impulse and (with luck) begins to divide and develop into an embryo. The 'embryo' is then implanted into a surrogate and a child could be born, a replica of the donor of the nucleus. Given the ability to clone

a growing range of mammals, it seems likely that human reproductive cloning would be feasible. The cost would, however, be prohibitive for most of us. Moreover, the risk to the women bearing the clones and the clones themselves remains huge. the 'wastage' is immense. there is little support currently to allow reproductive cloning.

Scientific evidence

As far as reprogramming technologies of human cells and of human cloning are concerned, scientific evidence and additional uncertainties will not allow to use either one of these technologies in producing embryonic constructs [7]. Embryonic constructs are not embryos in the traditional sense as they are not derived from the merging of two nuclei of haploid genetic property. No medical oversight or regulatory body would approve experimenting with embryonic constructs for reproductive purposes; no quality standards can yet be written; even topics and requirements for such quality features can not be formulated today. However, the actual situation of scientific ignorance in cell programming and nuclear transfer should not exclude ethical and religious discourse on using these technologies in the future for reproductive purposes; such a discourse would be useful, even warranted for self-understanding and selfevaluation of individuals, communities, cultures and for eventually preparing for future national and international legislation and regulation. It has been argued that some people, particular in traditional Asian culture favoring male offsprings, would somatic cell nuclear transfer techniques to produce babies, if originally developed for therapeutic purposes. However, such a suggestion underestimates cultural family quality standards of potential users of re-programming technology, expecting a "dream child" or at least "any normal child" and not a product resulting from an embryonic construct of unknown and questionable genetic mix-up and disorder.

The potential use of cell reprogramming and somatic nuclear cell transfer for therapeutic purposes and medical research represents a different set of technical and moral risk. Saving of life, the curing of diseases or at least the alleviation or reduction of pain and suffering has been one of the prime and undisputed moral goods in all cultures and in demand by individuals, communities and societies; experts in these fields have been gratefully honored and praised. Medical research and medical treatment finds religious and humanist support everywhere and is asked for and demanded by citizens as being vulnerable and mortal beings. It is out of question that medical research and treatment need to be "safe" and need to involve "informed consent or contract" of probands or patients, as probands or patients might decline participation in some or all research or refuse certain forms treatment based on their individual understanding of moral or medical risk.

Conclusion

Cloning falls within the narrower field of genetic engineering and the cloning process of people is still in the research phase. We can distinguish cloning at the level of the genes, DNA, individual cells, tissues, but also at the level of the whole organism. The clone of an adult organism represents a genetically identical duplicate of the parent entity which is obtained by transplanting the parent cell into the denucleated egg cell of the other entity. By the other cloning method the clone is obtained by splitting embryos at the earliest stage. There are two ways of applying cloning, first refers to the reproduction of the whole entity, while the other relates to the production of stem cells, which are multiplied and used for the purpose of treatment. By cloning is being question of the identity and purpose of the clone itself, and entails different ethical but also legal implications. Only the question of the ethics of cloning remains fixed and unfinished, so the whole problem is shifted to the area of law.

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