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Definition: **cloning** from *Cambridge Dictionary of Human Biology and Evolution*

1.

Creation of a collection of genetically identical individuals that have been derived from, and are identical to, a single parent; aka whole organism cloning.

2.

In biotechnology, cloning usually involves growing genetically identical cloning vectors or host cells — usually bacteria, yeast, or nonhuman mammalian cells grown in culture — which all contain the same piece of inserted recombinant DNA, including the target **gene**. See **genetic engineering**.



Image from: [Dolly the sheep, the first animal cloned from DNA... in Science in the Contemporary World: An Encyclopedia](#)

Summary Article: **Cloning**

from *Encyclopedia of Death and the Human Experience*

The concept *cloning* refers to artificial embryo twinning, somatic cell nuclear transfer, and removing stem cells from embryos and adult individuals to be used to “grow” tissues, organs, or individuals. Embryonic cloning involves using an electric current or other technique to split a preembryo into two, each of which has the potential, under optimal circumstances, of gestation and parturition to develop into a member of the species. The more powerful technique of somatic cell nuclear transfer involves the removal of the nucleus of an unfertilized ovum and replacing it with the nucleus of a somatic cell, such as a skin cell, and then using a small electric current to cause these combined elements to reverse the specialization and revert to stem cell status. The resultant cell is somewhat like a fertilized ovum, except that the bulk of its DNA is that of the donor organism with the exception of the mitochondrial DNA that comes from the ovum. Finally, one goal of human therapeutic cloning is to produce cells that are progenitors of those for specific organs, not entire organisms. Such cloning is commonly referred to as therapeutic cloning: the cloning of organs and tissues that are histocompatible with a potential recipient of a transplantation of the resultant cells or organ. To date, cloning as a technique is in its infancy. Medical science has little interest in cloning individuals or in artificial twinning. The major thrust is toward human therapeutic cloning.

Cloning and Death

The prospect of death, whether of oneself or a loved one, frightens most humans. The fear may involve various dreadful prospects supposed to await the dying person, from hell's fires, to the pain of separation, to the experience of nothingness. Even those not burdened by belief in an afterlife of judgment seek to remain alive as long as life holds a positive balance of meaningful activity.

Humans have long sought to extend life and forestall death by imprecations, pharmacological supplementation of essential physiological chemicals, surgical removal of tumors, and repair of injuries. In pursuit of longevity humans will cut calories to close to a starvation regimen, ingest unproven and disproven drugs (like laetrile), employ useless procedures (like coffee enemas), and take combinations of substances (like mega-vitamin therapy) believed through a combination of anecdote, assurances, and

gullibility to beat back cancers and other life-threatening conditions. More recently, replacement of organs with transplants from donors, living and dead, human and animal, have become the more scientific tools of life extension. Modern medicine and its alternative imitators have become the first and last hope of the sick and dying.

The relatively recent emergence of human reproductive cloning techniques has added several other stratagems to the tempting arsenal of weapons against imminent death. This entry discusses the present technology of human reproductive cloning and the possibilities of human therapeutic cloning for replacement of lost or injured parts and for replication of highly valued individuals.

Cloning and Immortality

Some individuals view cloning as a kind of immortality. But such views are not consistent with the facts. A clone is a much younger twin of the cloned individual. Just as, when a twin dies, it is not claimed that he or she somehow lives on in the survivor, so it wouldn't be said of a clone that he or she is "the spittin' image," or exact duplicate or replica, of the source of the cloned DNA. The reason is that a clone would be raised by different parents in a different time with different influences on its development. Identity has as much to do with the specifics of time and place as it does with genetic endowment.

Clones as Organ Farms

However, there are other attractions to having a clone twin. A clone would be a potential source of transplantable organs for an individual who suffers from severe vital organ failure. And the transplantable heart or liver or kidney would not require suppression of the immune system, as it likely would be recognized as "same" by the individual's defenses against foreign protein. Transplanted organs from cadavers or neomorts are typically histologically incompatible with the recipients, necessitating a life-long regimen of drugs to suppress the immune system.

The problem with this "solution" to the need for transplantable organs is that, to date, the ability to clone humans as "organ farms" is highly constrained by both ethical and practical considerations. Ethically, of course, creating another human individual to serve as a potential source of organs is a monstrous idea that violates the most fundamental canons of morality. Such clones, created specifically to provide older twin siblings with a pool of compatible organs, would return the world to a kind of exploitative slavery the equivalent of enslavement practices of the past. Their lives would be forfeited at any time a vital organ was needed by the older twin, and their lives would be otherwise inconvenienced by the need for nonvital organ, tissue, and blood transplants and transfusions. Even if the usual protections of informed consent were scrupulously applied, the clone would be under constant pressure to view him- or herself as in thrall to another, more favored person.

But ethical scruples are not the only reasons not to move toward human cloning for transplantation's sake. As was learned from the unfortunate cloned sheep, Dolly, whose life span was half that of an ordinary sheep, cloning from adult cells (e.g., skin cells), in the rare case where the effort works, produces an individual already physiologically much older than an infant normally conceived. The apparent reason is that cells from a mature individual have begun to accumulate genetic errors caused by exposure to radiation and other environmental elements, and such breakage serves as a precursor to all manner of disorders, including cancers. To put the point colloquially, the clone created from the DNA of a mature human's somatic cells is born already aged with a biological age roughly equivalent to that of the source of the DNA.

It might be possible to clone an infant and then freeze the embryonic clone to be thawed and gestated upon the need for organ replacement arising in the older “twin.” Such a procedure, however, is in conflict with the ethical principle of respect for individuals that serves as a barrier to any such stratagem.

One other theoretical possibility would be to manipulate an embryonic clone, if we had the understanding of development sufficient to do it, to produce only a specific organ for transplantation. In such an approach, the normal embryonic development that is directed by the embryo's DNA in utero would be managed so as to produce only the desired organ. Just how this could be accomplished in utero is unclear and unknown, but it might be possible to “grow” vital organs and other tissues in vitro until mature enough for transplantation. If the clone had been “begun” while the “older twin” was still in infancy, then cryopreserved until it was evident that a vital organ would be needed and subjected to a still-nonexistent methodology of developmental management, such a fantastic possibility might be realizable. But we are far from such therapeutic cloning. More likely is therapeutic cloning of important tissues in vivo, where the normal processes of cell regeneration are managed so as to replace damaged or diseased cells and organs.

Cloning as a Way of Regaining the Individual

Cloning has already been used as a way of “recovering” beloved pets. For individuals with extraordinary disposable income, the cloning of a pet from the cells of a deceased animal offers the illusion of a numerically identical replacement. Apart from such expensive sentimentality, cloning of valuable animal stock, such as a prize bull or racehorse, may be attractive to those who view such animals as utilitarian investments.

Those who have lost children may find the possibility of cloning “replacements” to be powerfully attractive. A parent who has lavished love and nurture on the developing child, only to see him or her struck down by an accident or assailant, might well find the possibility of “starting over” on “that child” to be deeply compelling. One individual who struggled with this possibility is Thomas Murray, President of the Hastings Center for Society, Ethics, and the Life Sciences, whose daughter was murdered in college. In a moving essay Murray reviews the temptation to seek a replacement through cloning his daughter and rejects it as providing a false hope, the illusion of a replica where, because of the unique nature of the lost person and her relationship with others, no replica is possible. He concludes of his lost daughter that it would be preferable to keep the memory of his daughter alive than attempt to produce a genetic facsimile.

Another philosopher, James Lindemann Nelson, has observed that the life of a clone would be inescapably linked to the set of expectations and potentials of the one who has been cloned, so that his or her life would lack the joyous spontaneity that comes with forging one's own identity. While serving as a replacement for one tragically lost might console those grieving that loss, the expectations placed on such a clone would constitute a burden that is both unfair and tinged with pretense.

A straightforward utilitarian reason for cloning individuals would be to recover the talents that particularly gifted persons may have. Many assume Albert Einstein was unique in his genius. Luciano Pavarotti thrilled millions with his stunning arias. Salvador Dali astounds with his inventive genius expressed in depictions of the familiar rendered unfamiliar. Some think these geniuses should be recaptured for posterity.

Apart from the psychological problems, replacement cloning is likely destined to disappoint. Not only are there problems associating with aging DNA, but the influences and conditions that surrounded the cloned individual will differ from those that obtain for the clone. In addition to this immutable fact, present and envisioned technology cannot overcome the dismal morbidity rate of cloned offspring that plague virtually all cloning efforts for animals.

The benefits of cloning we are likely to see in our lifetime are modest but important. We will come to integrate into medicine's practice the cloning and transplantation of specific tissues and structures as replacements for diseased or damaged ones, enabling lives of normalcy to be realized for those who today struggle with chronic diseases such as diabetes. But regeneration of entire individuals is both improbable and quite possibly a nightmare masquerading as a dream. Cloning, like other life-extending measures, may enable the living to enjoy better lives: For those who have lost loved ones tragically, they will continue to live with their sorrow.

See also

Death Anxiety, Life Support Systems and Life-Extending Technologies, Organ and Tissue Donation and Transplantation, Transcending Death

Further Readings

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