

FAQ's About Cloning

Is cloning "unnatural"?

Not at all. Some organisms, such as bacteria and yeasts, only reproduce using cloning. Some larger organisms, like snails and shrimp also reproduce by cloning. As sexual reproduction is the only way to improve the genetic stock of a species, most asexual species tend to die off. However, at least one - a shrimp called *Artemia perthenogenetica* - has survived for at least 30 million years without reproducing sexually. Many more species, including the aphid, reproduce by cloning most of the time and then reproduce sexually every few generations. Perhaps one day humankind may follow their lead.

Is an identical twin essentially the same as a clone?

Only if the clone is born at the same time from the same womb as its clone. We now know that what a fetus is exposed to in the womb - nutrition, alcohol, drugs or perhaps even stress hormones - can influence its physical and mental development.

Could some lunatic clone Hitler if human cloning were perfected?

Just possibly - but they wouldn't get what they wanted. First, they would need some living cells from his body - and unless it was frozen or otherwise preserved soon after death, the cells would probably be unusable. More importantly, because of differences in the environment of the womb and upbringing, cloned Hitlers would not act, think or even necessarily look like the original.

Could clones be "farmed" to provide spare body parts for their "parent" clone without problems of tissue rejection?

Possibly, although we don't know enough yet to be confident that rejection would be eliminated entirely. You would also have to wait a number of years until the clone's organs were mature enough to transplant. In addition, your actions would be highly illegal unless your clone was willing to act as a donor. Remember, a clone would be just as human as you or I. Even leaving aside the ethical concerns, with the progress that is being made in understanding and coping with tissue rejection, you would be more likely to have a pig's heart in your future than a clone's.

Would a clone have a soul?

Though I am not a theologian, if you grant souls to the various kinds of "test tube babies" already being born, then it follows that a clone would have a soul also.

Could people be cloned without conscious brains (so their body parts could be harvested with fewer moral qualms)?

No. For starters, whatever consciousness is, it doesn't reside in any one brain structure or set of genes that could be easily removed from the clone before or

during its development. Moreover, attempting to surgically or genetically erase someone's "consciousness" is itself morally wrong. It would also be hard to know if your technique worked. A person can look and behave like a mindless vegetable but have a very active mind. For example - the paralyzed French writer, Jean-Dominique Bauby. He dictated a 130 page novel by moving his eyelids.

Could vital organs be grown using cloning without the rest of a body?

Possibly - but nobody is even close to knowing how. Contrary to scientists' expectations, the birth of Dolly shows it is possible to reprogram the cell of an adult (or at least its genome) so that it begins development all over again. This newly discovered flexibility means it may one day be possible to reprogram skin or blood cells so that they grow into "spare part" tissues and organs, rather than whole organisms. However, the technical obstacles will be huge.

Could cloning be used to create "super warriors" or super-intelligent people?

Possibly - though we don't yet know enough about human genetics to do much "improving" of people. So far, because of ethical concerns, geneticists are concentrating on finding the causes of genetic diseases and then curing them. Cloning makes it easier to meddle with human and animal genes but is not necessarily genetic improvement. Even before recent discoveries, a considerable amount of genetic improvement of animals was already taking place. A thoroughbred horse is essentially genetically engineered, for example.

Genetic engineering is rather a hit and miss technique. You try to add the gene you want in the right place, in the right cell, and sometimes that works. Before cloning, genetically engineering a sheep, for example, might have involved injecting DNA into the egg or early embryo. It was only once the animal grew up and was tested that it was possible to see if the desired genetic change had been introduced and stably incorporated into the animal's germ-line.

Cloning, in theory, allows you to turn any cell into an animal. So instead of injecting DNA into an egg, you can shoot DNA into cells in a Petri dish; allow them to grow; and look among millions of cells for the type of genetic alteration you want. Since it is so much easier to manipulate cells than sheep - not to mention the fact that it is easier to feed 100,000 cells than the same number of livestock - much rarer and more subtle gene manipulation can be accomplished, such as replacing one gene for another, or changing a single DNA letter of a gene.

Once you have cells with the desired genetic character, they are fused with an egg from which the chromosomes have been removed. Any animal that grows up from that experiment will have the genetic change in every cell of its body.

Could cloning be used to save endangered species?

At the moment its success rate is very low - Dolly was cloned after 276 attempts. If this can be improved on it might well turn out to be useful to increase

the population of hard-to-breed animals. Extinct animals (or animals without females) would be more difficult. A female can't normally give birth to an animal of a different species, although in certain cases a female of a closely-related species could give birth to a clone of a different species.