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Why cloned animals but not cloned humans

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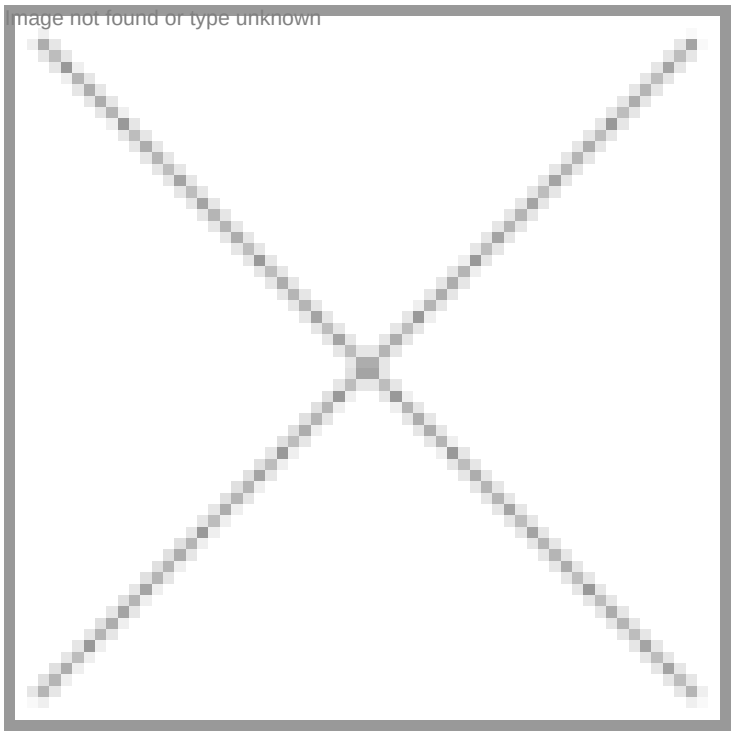
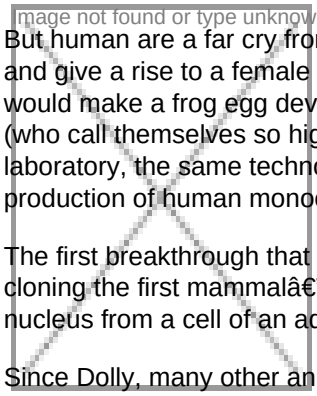


Cloning means generation of exact replica. Nature has been exercising this option all through evolution. In fact, it was probably the only option it had for long after life appeared on our planet some 3.5 to 4 billion years ago. Prokaryotic microorganisms were almost certainly the first living things on our planet. Even today such microorganisms generally propagate through asexual reproduction, which is nothing but a natural way of cloning.

But, then, man has acquired through evolution, a built-in imperative to try to do better than nature. So man has learnt to clone plants, all plants grown through cuttings are clones of the plant from which the cutting was derived, and microorganisms. In the second half of the last century, scientists also learnt to clone animal cells by growing them in tissue culture.



Pushpa M Bhargava

But human are a far cry from plants, bacteria or even other animals. For example, you can make a frog egg divide by itself and give a rise to a female frog. This process is called parthenogenesis. But human eggs refuse to respond to signals that would make a frog egg develop parthenogenetically. Similarly, while frogs are extremely resistant to bacterial infection, we (who call themselves so highly developed) are not. Again, we can make mouse monoclonal antibodies easily in the laboratory, the same technology (for which a Nobel Prize was given to Cesar Milstein and Georges Kohler) does not work for production of human monoclonal antibodies.

The first breakthrough that laid the foundation of possible human cloning came in 1997 when British scientists succeeded in cloning the first mammalâ€"an adult sheep. Dolly, the clone, was produced by transferring the genetic material-containing nucleus from a cell of an adult sheep into an enucleated egg of another sheep.

Since Dolly, many other animals have been cloned. In 1998, 50 adult mice were cloned from a single adult mouse and 8 calves from a single adult calf. In 2000, pigs and goats, and in 2002, cats and rabbits were cloned. And 2003 saw the production of the first cloned horse born on the 28th May in Italy.

Although, recently, claims have been made about successful human cloning, none of them have been substantiated, even though no one doubts that human cloning is now feasible, whatever big jump it may be from other species to humans.

Since we do not have an established human clone yet, this is the time to ask the question: should we or should we not encourage human cloning and invest in research on it? To answer this question, we must ask as to what use it all would be. As it is no longer a major scientific challenge, it must have some practical use for mankind to invest in it.

Two such uses have been postulated: one individual and the other general. The individual use could be the satisfaction of ones ego or perpetualization of someone whom you may admire for whatever reason. So you may think you are an extraordinary person whom the world would miss; you may want too perpetuate yourself; or you may want to clone Madhuri Dixit, Shabana Azmi, Sachin Tendulkar or MF Husain, for you admire them. This is what is called reproductive cloning.

The other reason would be to generate organs for transplantation on a human. Today, at any given time, there are over 90,000 people waiting for a kidney transplant, but there are only some 2,000 kidneys available. Further, transplant of a kidney from an individual, a homograft, requires the recipient of the foreign kidney to be kept on expensive immunosuppressive drugs for a long time.

Commercial therapeutic cloning could change the scene. If you need a kidney transplant, the organs from your cloned fetus could be harvested just after oraganogenesis has begun, grown further in organ culture and then transplanted on you. Since immunologically they would be just like your own organs there would be no immune response and, therefore, no need for immunosuppressive drugs after the organ transplantation.

The reason given above for reproductive cloning does not stand scrutiny. We are what we are because of two factors: genetic and environmental. The genetic factors determine our capabilities and the environmental factors determine the extent to which these capabilities would convert into abilities. Therefore, while your clone would have the same capabilities as you, since the environment in which you were brought up, the extent to which these capabilities would convert into abilities and the fall out of this process would be very different in the case of your clone than in your case. Therefore, the clone will not grow up to be identical to you.

Thus reproductive cloning would make no sense. It would only lead to frustration on the part of the person who is being cloned, besides waste of resources, it would also make the life of the clone extremely difficult because of the expectations from the clone, which he/she may not be able to meet.

On the other hand, therapeutic cloning makes sense. There should be no objection to it until the time we learn to grow more organs from totipotent stem cells.

What about cloning of other animals? I am all in favor of cloning animals, other than man, for reasons such as those that I give below.

Today's repertoire of medicines for various human diseases and disorders includes a large number of therapeutic human proteins. Till recently, they had been very expensive, if available at all in any reasonable quantity. We have been able to reduce their cost by making microorganisms produce some of them through genetic engineering.

We can reduce the cost of such proteins further by having them secreted in the milk of appropriately genetically engineered cattle, sheep or goat. In fact, it has been shown that we can have them secreted at concentrations of 1 to 15 milligrams per

milliliter, which would make the cost of their production of the order of about one dollar per gram. Thus reducing their cost by several orders of magnitude in comparison to today's cost of such proteins. The way to do this would be to produce one animal, say through microinjection of the desired DNA in early embryos or even the zygote and then hoping that at least one animal treated in this way would give us the desired phenotype. We can then clone this animal and produce any number that would secrete the desired protein in their milk.

Cloned animals can also serve as a source of organs for xenotransplantation on humans. It is now widely recognized that pig is the most suitable animal to donate organs to humans. But there is a serious problem of hyper immune rejection. It is now possible to produce genetically engineered pigs in which this protein is inactive. Once one such genetically engineered pig is available, there is no reason why we should not be able to clone it to give us a perpetual supply of organs to be used in humans when the technique of xenotransplantation is perfected.

Mules are extremely useful animals but, being a hybrid, they are sterile. In 2003, mules have been cloned. There are still problems that need to be solved but, when perfected, the mule cloning technology may be of great commercial value for India.

Horses are often castrated to improve performance in respect of certain activities. The recent success in cloning horses could be used for cloning such castrated horses that have a highly improved performance. In fact, what is becoming clear is that genetic engineering and cloning will often go together in the future. This would have immense possibilities in the area of developing new classes of animals that would solve some major problems of humans.

Unfortunately, in our country, there is virtually a total lack of awareness of the above. Let me give an example of this lacuna. Shantha Biotech, highly respected pharmaceutical company that produced the first genetically engineered product in the country, and the National Dairy Research Institute, one of the most prestigious laboratories, of the ICAR system, jointly submitted a project under the Millennium Initiative that is administered by the CSIR, for producing genetically engineered and cloned animals for secretion of drugs into their milk. The project was not approved and no viable reason was given. The reason can only be non-scientific, for much less meritorious projects have been liberally funded under the above initiative.

Pushpa M Bhargava is one of India's most brilliant scientists. He founded and directed the Centre for Cellular and Molecular Biology (CCMB), Hyderabad.