REVIEW ARTICLE

Cloning Technology Today : The Human Cloning Debate

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Abstract:

Among the two types of cloning, therapeutic and reproductive, therapeutic cloning seems to have fewest opponents. Therapeutic cloning promises invaluable treatment for serious diseases like Parkinson's disease, Alzheimer's disease, multiple sclerosis, diabetes mellitus, rheumatoid arthritis and even fatal conditions such as AIDS and cancer. On the other hand, reproductive cloning is about creating life having identical genes with frightening possibilities particularly for human cloning. The challenge facing the would be pioneers in reproductive cloning is to make a convincing case that the human cloning technology is not immoral, however immorally it could be used.

Introduction:

Cloning is a Greek word meaning 'asexual reproduction'. There are two types of cloning: therapeutic cloning and reproductive cloning. Therapeutic cloning technique allows the creation of human embryonic stem cells which can be specialized to make any kind of cell in the body such as brain cells, heart muscle cells or liver cells. These artificially created specialized cells can be used to fight diseases and even to make new genetically compatible organs. Therapeutic cloning seems to have fewest opponents as it promises invaluable treatment for serious diseases like Parkinson's disease, Alzheimer's disease, multiple sclerosis, diabetes mellitus, rheumatoid arthritis and even fatal conditions such as AIDS and cancer. Embryonic stem cell technology is recognized as the 'holy grail' of tissue engineering and it has been advanced further by observations that adult bone marrow stem cells has the capacity to enter the brain, and generate neurons and other brain cells. Adult stem cells may provide many of the same advantages as embryonic stem cells but without ethical concerns[1,2,3,4,5]. Reproductive cloning technique is a new procedure to give life to an identical twin of the original cell donor and before this, only sexual reproduction or artificial methods like in-vitro fertilization (IVF) existed. Reproductive human cloning, which produces a human being with the same genes as another human being, provokes the greatest debate and controversy and clearly, there is a need for reflection[6,7].

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Cloning: When did it all start?

The first cloned mammal 'Dolly - the sheep' was achieved by Dr. Ian Wilmut and his team, Scottish scientists, working at the Roslin Institute, Scotland, UK in February 1996. It

quickly became the most photographed sheep of all time and was invited to appear on a chat show in the USA. Dr. Ryuzo Yanagimachi of the University of Hawaii, Hawaii announced the cloning of mice in July 1998. Subsequently, Japanese researchers from Kinky University, Hawaii, cloned eight calves from a single adult cow's DNA. Soon the cloning became a global phenomenon. Two Korean scientists, Dr. Kim Seung-bo and Dr. Lee Bo-Yeon, attempted to clone specific and genetically identical human organs for transplantation, known as therapeutic cloning. By the end of the year 2000, eight mammalian species have been cloned including mice, cows, monkeys, sheep, goats and rats[8,9].

A French scientist, Dr. Brigitte Boisselier, claimed the birth of the world's first cloned human baby in December 2002, but little more has been heard since then. The opponents of reproductive human cloning immediately issued statements criticising the study. Of much more interest, however, is therapeutic cloning which may lead to the ability to clone adult human cells to 'grow' new hearts, liver, kidney and/or nerve cells. While the Human Fertilization and Embryology Authority (HFEA), UK is adamant in its opposition to reproductive human cloning, it views therapeutic cloning positively. As a step further, the HFEA, UK has granted license to Professor Ian Wilmut to carry out therapeutic cloning[7,10].

How 'Dolly -The Sheep' was cloned?

Until Dolly the sheep, all cloned animals had arisen from a nucleus taken from embryo or foetal cells and transferred to an egg whose nucleus had been removed. Instead, to create Dolly, a nucleus from a mammary gland cell taken from a six-year old sheep was placed into an oocyte from another type of sheep – an oocyte whose nucleus had been removed by a technique called nuclear transfer. A light micrograph of the transfer of nuclear material is presented in Fig.: 1[7]. The steps of the technique for cloning Dolly-the sheep are stated in Fig.: 2[8]. The cloned sheep Dolly is represented in Fig.: 3[9]. Dolly's debut caused tremendous concern in many nations about the ethics of probable cloning humans.

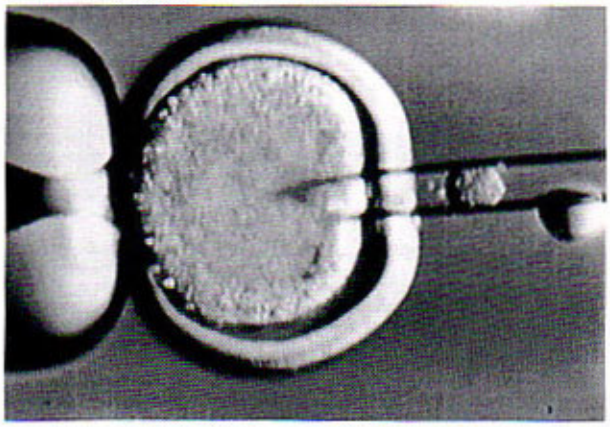

Figure-1 : Light micrograph of the transfer of nuclear material to an egg that has had its genetic material removed during the cloning of a sheep (taken from reference no. 7).

What is the technology for reproductive human cloning?

The reproductive cloning provides a genetic duplicate of another creature. The predominant method around the world entails removing the nucleus or core from the egg and replacing it with nuclear material (DNA) from a donor. This nuclear material (DNA) "reprogrammes" the egg, transferring into it the entire genetic code of the donor (Fig.: 4)[7,9,11]

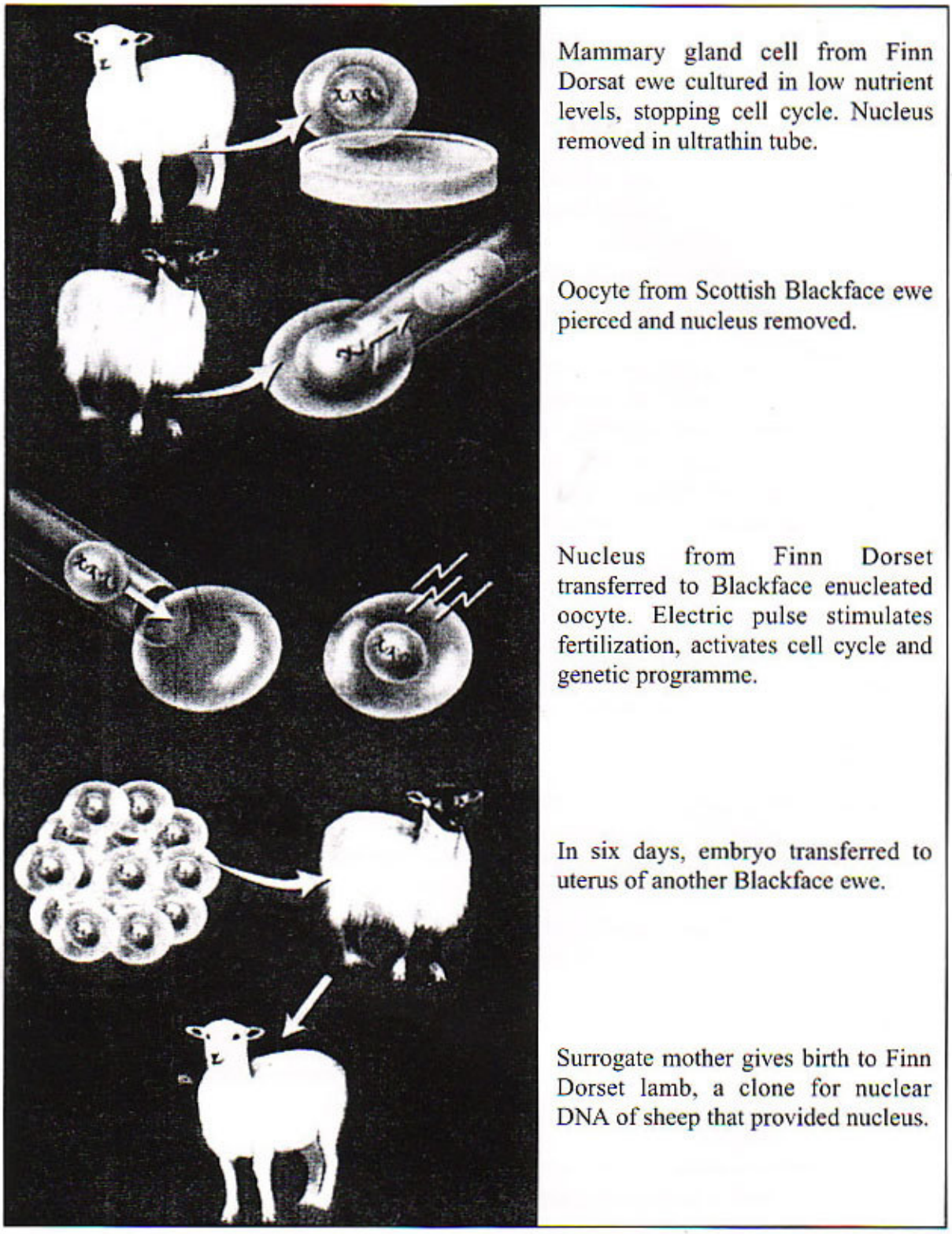

Figure-2 : The steps of the technique for cloning Dolly - the sheep (taken from reference no. 8)

Figure-3 : Dolly-the cloned sheep (taken from reference no. 9)

To clone or not to clone a human being?

Human cloning which produces a human being with the same genes as another human being provokes the greatest reaction. The subject of cloning, in its various guises, is a topic likely to produce markedly polarised opinion in any debate. The cloning of babies present a huge array of problems. The foremost is the fact that even the cloning of mammals/animals is still at a rudimentary and imperfect stage. Dolly - the sheep, the first cloned mammal, developed arthritis and began ageing prematurely. Many other cloned animals have died. Regarding human reproductive cloning, not enough is known about the process. The process involves wasting hundreds of eggs and embryos, difficult pregnancies and miscarriages or abortions, high number of deformed features and possible mutations. The cloned babies may manifest degenerative tendencies and malignancies, and may have a short life span7,12.

A world in which cloning is common place may well introduce many strange possibilities. For instance, a woman could give birth to her own clone - is the child her daughter or her sister? A couple have a cloned son and divorced subsequently - how will the mother feel about seeing a younger identical copy of the person to whom she was once married? Consider how twins are acknowledged as unique individuals, each with their own anatomy, personality and each possessing a soul, which can not be cloned even though their genetic fingerprints are the same!

All these evidences support the common criticism that human cloning is unnatural and appears to be immoral.

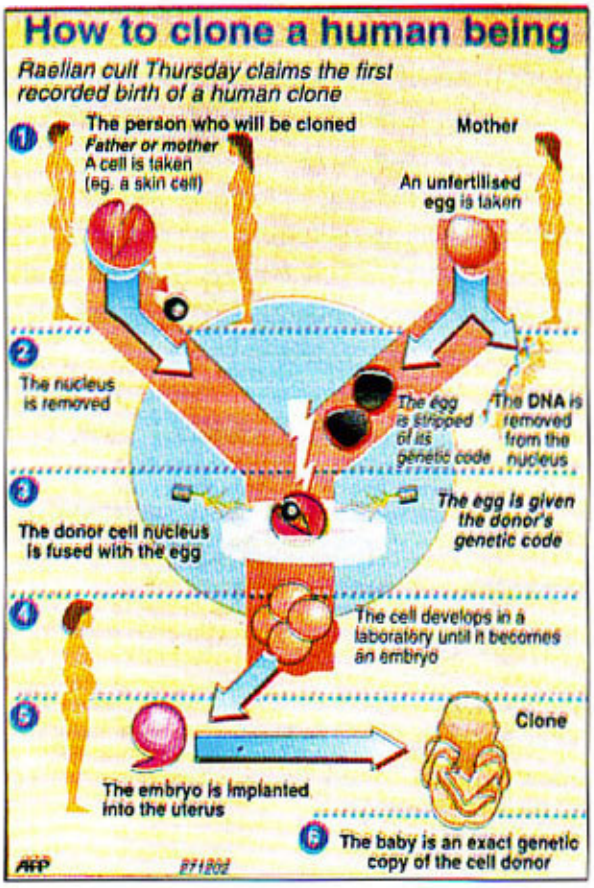

Figure-4 : The steps of human cloning (taken from reference no. 11)

If we do something that undermines human moral nature, then this is deemed to be against nature itself. At the same time, some positive aspects of cloning must also be considered. What about an infertile couple who desire to have a child? Does human cloning really do any harm? Are there any benefits of human cloning?

In spite of such frightening possibilities, countries around the world are undecided whether to completely ban human cloning or not. Clearly, the challenge the possible pioneers in this particular field would be facing is to make a convincing case that the human cloning technology is not immoral, however immorally it could be used[7,12,13].

However, therapeutic cloning is of special and definitive interest. Therapeutic cloning is all about saving lives, whereas reproduction (human) cloning is about creating life. So, it is unlikely to create a climate in which people would be encouraged to use cloning as a means of reproduction[7,12,13,14]. A United Nations legal committee recommended that member nations should be urged to ban all forms of human cloning and in fact, General Assembly adopted United Nations declaration on human cloning ban by vote 84-34-37. The decision however undermines efforts to develop medical treatments with stem cells, scientists say[4,5,13,14,15,16].

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