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Cloning of Animals with Its Applications and Ethical Issues

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Abstract:

Cloning, the term is defined as the production of an individual having the same genetic identity of their original individual. Natural cloning occur in animals and humans in which new individual is formed from the parent organism's single cell's copy. Natural cloning is also known as identical twins, produced by the fertilized egg splits in two or more embryos. These embryo have identical DNA. Now in recent time, artificial cloning is done for many purposes as to secure the genetic data of endangered species. This cloning technique has positive impact on the agriculture animal biotechnology industry, human medicine and animal conservation. This paper represents the cloning methods (embryo splitting and nucleus transfer) which help to provide the high quality cloned animals. Cloning technique has many advantages which also discussed in this paper. Some ethical issues are seem in the animal cloning as the invasiveness of animals, and objections by the people.

Keywords: *Cloning, Nuclear Transfer, Ethical Issues.*

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Introduction

An individual which is genetically identical to one individual is known as clone of that individual. It is a form of asexual reproduction that spread nature. The normal process with these steps division, vegetative and reproduction occur in single-cell organisms and plants. By In early stage of division, the spontaneous division of embryos occurs due to which genetically identical individual arise in higher vertebrates. In this process, the parts are evolved separately into independent individuals. In the field of mammals, a new technology is cloning which is applied in the breeding of elite cattle, pigs, goats and sheep. Little data is present on which robust opinion is based and situation is changed in the research studies because of the various developing technologies. The cloning has a drawback as the species classification become difficult when the nucleus of an endangered animal cells is transferred to the pet animal egg that contains egg mitochondria and egg mitochondrial DNA.

Procedure of Cloning

The artificial cloning of higher organisms are based on the principle that has two procedures. The transplantation of nucleus to egg cells proceed the *embryo splitting* and cloning or embryo cells whose inherited material has been removed that means *transfer of nucleus.* The techniques of cloning come under the biotechnology in which the procedure is used that do not modify the inherited material in the cell nucleus. The techniques of cloning are used in isolation as well as in the combination with other biotechnology and genetic engineering techniques. Transgenic is a process that modify the genetic material. Biotechnology contain many procedure that are essential element for cloning, only some are optional.

The both procedures, embryo splitting and nucleus transfer are differ by their techniques and the degree of genetic identity that is achieved as a result of embryos. The age and potency of the cells is not changed in embryo splitting. The two or more embryos who are developed from splitting grow in same stage and have the same age as the undivided embryo are genetically identical. In nucleus transfer technique of cloning, the genetic program is transferred from a totipotent blastomer to an unfertilized egg cell. This unfertilized cell's nucleus has been removed previously. This nucleus transfer technique offers for the replication of an adult individual with their genetic program. The existence of this new individual cannot be driven by the process of fertilization of an egg cell through the sperm cell (Revermann and Hennen, 2000).

Cloning by Somatic Cell Nuclear Transfer

In case of normal fertilization, the fusion of sperm cell with the egg cell takes place which gives result in the form of zygote. Zygote contains a complete diploid genome. During the process of fertilization, sperm cell transfers a chemical signal to egg cell called as activation by which egg is triggered to resume the cell cycle and the development of embryo begins. Zygote is known as totipotent cell because it is able to form a complete organism.

In case of nuclear transfer, the replacement of nuclear genome (DNA) of one cell is takes place with another nuclear genome. The microscope equipped with micromanipulators is used for the accomplishment of the maternal DNA, removed from the oocyte while electrofusion introduced the donor DNA. The donor cell DNA is transferred into mature oocyte which has already removed the DNA, give the result in the form of live animal, this is a nuclear transfer unit. The combination of chemicals which are used to induce the biochemical events by which the process of fertilization is stimulated. This combination of chemicals helps in the activation of newly formed nuclear transfer unit. Then, the nuclear generated embryo is implanted into a surrogate mother for producing a cloned animal (Page and Ambady, 2004).

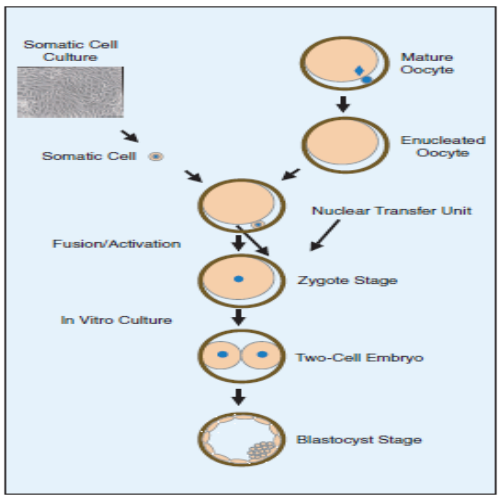

Figure 1: Process of Somatic Cell Transfer

Animal Genomics

Agriculture animals have economic importance to the food production industry because of having the desired traits such as high milk yield, meat tenderness, rapid weight gain, consistency of product, utilization of efficient nutrient and disease resistance. In the past, to increase the value, the animals which have these traits are exploited by the selective breeding based on actual performance data. There is a need to attempt and studies on the many breeding combination to establish

which animals show the desirable traits most efficiently. For example, the progeny testing which takes approximately five years to establish which bulls produce the daughters that give the most or best quality milk. The second drawback is that the phenotype of an undesirable recessive trait could not be displayed by bull. This recessive trait could be passed along to his progeny. Hence it is necessary to develop a better methods for selecting the seed stock animals by which the future generation of producing animals can be generated.

In last few decades, the subject of animal genomics has more attention as the researchers developed a correlation between the specific gene loci and characteristics of meat (Marbling and Tenderness). The relation of genetic to the animal breeding can be defined as the use of genetic information at DNA level for the development of correlations by which performance criteria can be established for particular traits. For the prediction of the ability of passing the desired traits along to the progeny, genomic information could be used. This technology has immense power (Page and Ambady, 2004).

Applications of Cloning

The main type of cloning is the cloning by the somatic cells from individuals which can show the serious of aptitudes of interest in their lifetime. The genetic value of an embryo which is a nucleus donor have many uncertainties. Agriculture researchers are also interested in cloning such as cow, pigs, sheep, goats and poultry. Here, four areas of application are defined as follows:

Emergency Cloning

- In selection programme, an animal of interest can be cloned to avoid the loss in the genetic progress.
- For non-breeding animal, genetic progress would be promoted by the cloning animal.
- An animal of interest to be breeder may be useless. In this condition, copy of that animal is necessary as a breeding animal.
- An embryo implanted into adaptive female, is the source of nucleus donor cells. The few cells of embryo can be taken but without compromising the embryo development. The obtained embryo from the cells has more potential to develop high number of cells which are sufficient for genetic typing of original embryo.

Cloning for Genetic Dissemination

Natural service methods are adopted by some herds (Beef cattle, dairy cattle partially) which may be beneficial from the advantages of this type of techniques. While in the artificial insemination, the better genetic quality of breeding animals can be accessed immediately. In this situation, some of parent male animals could be cloned and directed to natural service. The genetic progress would be stimulate in the long term as well as improvement in the economy of the herds would be seen. The maintenance of genetic variability should also be considered. For this, large number of different clones should be available and circulated. Clearly, A whole series of interesting zoo-technical capacities are built by the envisage cloning females. This type of application of cloning make possible for obtaining the certain desired quality of genetic more rapidly compared to conventional reproductive methods.

Cloning for Production

A basic component of production system is cloning that have immediate economic benefits to the farmers. In a simple words, the invention of new production systems is possible by the cloning. There is example to define this type of possibility.

Several clones of cows has been obtained by the farmer with a very balanced genetic profile (Good production without fertility or mastitis problems) resulting in the form of very good longevity. The crossbreeding is used by the farmer for the reproduction of animals except in case of replacement with other more recent clones. By this condition, the balanced of the system and production cost of clones are correlated. This case do not have impact on genetic progress in pure breeds. Only farmer maximize his immediate profit by the exploitation of the trait combining genetics.

Protection of Variability by Cloning

The accelerated destruction of genetic variability is caused by cloning. Cloned individuals are closely related with the existing population on average rate. However, leads to the genetic variability's strengthening. In this way, prolificacy is increased strongly. The technique is neutral, only certain conditions and prospective applications can give harmful result.

Selected Populations

The frequency of their genotypes are increased by the cloning female which are of interest but not represented within herds. The increased frequency of

genotyping rebalance the gene pool and has a favorable impact on the genetic progress in long term.

Preserved Populations

In most of the cases, the initial female's genomes are lost entirely because of the primary focus of selection system is on males. By the use of cloning, genetic life is prolonged that make possible to build up large stocks of female gametes. This give the result as the reduction in genetic drift and population's consanguinity. The immortalization of populations occur by the extreme application of this technique. And the retired individual is replaced by its own clone.

In the case of allotment of financial resources in the respective of two types of populations, everything would consider as a point of supplement of frozen semen stores involving frozen cell stores by taking the potential cloning as a major aspect. From the applications, it is clear that cloning is only one technique that would allow rapid resurrection of an extinct population (Afssa, 2005, www.anses.fr).

Ethical Issues in Animal Cloning

Two types of moral problems are raised in animal cloning. First one, the negative consequences are produced to animals, human beings and environment. And second, the important moral prohibitions and principles may be violated by it. The negative consequences to animals can be seen in two terms; narrowly and broadly. In narrow construed the animals are involved in the cloning procedure, suffered from the unbearable pain. While in broadly construed, the deleterious effects of cloning such as livestock, unwanted pets and endangered species. Animal cloning also affects the human beings in adverse way as the perfecting reproductive cloning techniques are applied on animals and then applying them in human reproduction cloning. Another impact is seen on environment. It may be occur by the breeding with non-clones and some unforeseen gene expression.

The ethical issues with the concern for animal welfare can be aroused in any stage of generation and life span of an individual genetically engineered animals. The Canadian Council on Animal Care (CCAC) gave the guidelines development process and impact analysis consultations in which some ethical issue was raised. The work is done by CCAC on the accepted ethic of animal which are used in science. CCAC has principles of three Rs. These Rs are:

- Reduction in animal numbers
- Refinement of practices and husbandry to minimize distress and pain.
- Replacement of animals with non-animal alternatives.

These three Rs aim is to minimize the pain and distress which are experienced by animal during cloning procedure. Same principle are followed in human experimental techniques.

Other than these issues, Invasiveness of procedures in which some animals sacrifice, requirement of large numbers of animals, and unanticipated welfare concern are also included in the issues. Because of these issues, the genetic engineering procedures become less of a welfare concern over time (Fiester, 2005; Ormandy, Dale and Griffin, 2011).

Review of Literature

Revermann and Hennen (2000) stated that the nucleus transfer is a new approaches in the developing of transgenic animals. Cloning is able to produce some protein with the therapeutic effect. The high potential benefits in the field of research and medicine is gained by the use of nucleus transfer cloning procedure. The production of clones of breeding stock in agriculture field can improve the animal performance and quality means high performance animals.

The ethics in animal cloning should be followed which are used in traditional animal breeding. The national ethics commission are created by various calls that deal with the moral and ethical issues in biological and biomedical technology and in non-human biology and medicine. The analysis of animal cloning's legal aspect indicates, it has legal permission with only limited restrictions in present legislation. The protection of animal is necessary in the field of cloning.

Tian *et al.*, (2003) researched on the somatic cell nuclear transfer for the cloning procedure and concluded that it is a new technology which has many applications. The reprogramming of epigenetic inheritance is done by the nuclear transfer which is still incomplete at the current stage of development. The perfection in this technology is necessary by the further efforts and new paradigms. And then extend this technology to its highest potential.

Page and Ambady, (2004) proposed that the production of high quality animals with the more genetic value is possible by the cloning technology. The preservation of genetic seed stock is done by the cloning which will be helpful for future. The tool represent by the cloning on which the knowledge is collected from the animal genomics research and power of transgenic technology. The conventional selective breeding and culling of pet animals are used for the genetic gains. The improvements are based on

the trails and error b ecause of the nature of chromosome recombination events at the time of meiosis. In the end of paper, they concluded that the deliberate and precise modifications with highly expectable results can be attained by new biotechnologies in agriculture animal industry.

Fiester, (2005) concluded on the basis of their review study about the ethical issues in animal cloning that a serious analysis constituted by both consequence-based and principle based oppositions to cloning science that supporters of cloning need to consider. The negative view of public regarding the animal cloning can be understood on the basis of consequentialist grounds and also build societal consent around cloning of animals. The more attention should be received for these objections in public discourse. The ignoring of these objections do not have effects on the cloning science but it can create a serious implications for the commercialization and acceptance of cloning products.

Well, (2005) concluded that somatic cell nucleus transfer of cloning have many steps that face the trouble in the development of embryo and foetus and also affect the health during adulthood. Because of these reasons, there is a need to evaluate the technology for the longer-term consequences on the animal produced. According to them, for greater confidence in elite cloned livestock's breeding applications at large scale should have the molecular evidence that can determine the prospect of genetic or epigenetic heritage and also the effects on the future generations. With these points, the biology behind the nuclear cloning should also be understood by which the health and viability of cloned animals and their surrogate mother could be improved.

Camara *et al.*, (2008) discussed about the ethical issues such as cannibalism, suffering, threat and son on which are raised by the utilization of cloned and transgenic animals. But it is important to consider that human cannot live without nature and animals. On the other side, human harms the nature resources and tries to dominate over nature that can lead them to end. It is also seem that the human harm the animals. So, the aim is to determine the ethical limits beyond the exploitation of animals by human. This is done by the use of transgenic and cloning methods. The threat for dignity and respect of animals are Genetic techniques. So, it is necessary of a latency period in which analysis can be done for the risk of biotechnologies. These techniques lie beyond the limits of ethics.

Conclusion

This paper discussed about the cloning of animals for the many purposes like agriculture industry, human medicine and animal conservation. The cloning technique use the procedure nuclear transfer that has many applications. Some conclusion are drawn from this paper:

- By the cloning of endangered species, the extinction can be reduced and the genetic data of many species can be used for future perspective.
- Some animal breeding become useless due to which the production of new species are impossible. With the help of cloning, new animal clone can be produced with the high productive quality.
- The genetic variation is very important factor in humans as well as in animals. The cloning is very helpful to develop the differentiation between the species.
- In spite of having many applications, the cloning technique has ethical issues as accepted by people as some times the result of cloning produce a danger animals that are adverse effects on the human and nature.

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