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Biotechnological Developments in Animal Husbandry

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Abstract: ***Biotechnology covers all the studies that aim to obtain a new organism by using whole or part of plant, animal or microorganisms or to make changes in the genetic direction of an existing organism in the desired direction. Biotechnology in the animal field, which aims to ensure adequate and balanced nutrition of the rapidly growing world population; Investigation of cell, embryo, organ cultures, genetic structures of plants and animals, extraction of gene sequences, thus the emergence of new genotypes, the use of this information in classical breeding or the application of transgenic genotypes by direct gene transfer. Depending on the increase in population and technology, animal food needs and development do not exist. In this context, animal biotechnology will be the most effective area in the future. In this study; animal cloning, productivity and problems in farm animals, food safety, genetic engineering and environmental and ethical concerns.***

Keywords: Biotechnology, Food, Animal Cloning, Genetics, Ethical Concerns

1. Introduction

Biotechnology is defined as technology based on biology. From this definition, it is known that animal breeders have applied animal biotechnology for many years. For example, conventional selection techniques include the use of observations of the physical and biological characteristics of an animal to select the parents of the next generation. To understand the effects of humans on the appearance and characteristics of animals in a single species, one needs to look at the diversity of aquarium fish and dog breeds. Genetic development through selection based on an increasing understanding of population genetics and statistics has made a significant contribution to striking improvements in agricultural productivity (Dekkers and Hospital 2002).

Many different biotechnologies have been included in livestock breeding programs to accelerate the rate of genetic development. These include artificial insemination, sire test programs using data collected from thousands of children, oestrus synchronization, embryo transfer, freezing of gametes and embryos, and DNA-based marker-supported selection of genetically superior animals. (NRC 2002). Today biotechnology is widely used in agriculture in addition to the animal (veterinary) and human health. Advances in genetics using traditional animal breeding techniques have come at no cost, and there are concerns about health and well-being about high-yielding animals, such as gait abnormalities in chickens and fertility problems in high-yielding dairy cattle.

Animal Cloning

Cloning can be defined as producing a genetic copy of an organism. Single-celled organisms such as bacteria and yeast reproduce in this way. Single-celled bodies produce their copy by dividing after a certain time. In animal cloning, the cell nucleus containing genetic information is extracted from one of the cells cultured in the laboratory and taken from adult animals and transferred to an egg cell where the cell nucleus is removed. This egg cell is placed in the uterus of the surrogate mother animal to develop without having to fertilize with sperm. The animal born at the end of the pregnancy is identical in all respects to the animal that the owner of the cells from which the genetic material is taken is identical in all respects to the animal.When most people hear the term animal biotechnology, they think of Dolly, the first mammal cloned or copied from an adult cell. As a result of the complexity of information surrounding Dolly in 1997 and the impact of those technological advances such as snow, the debate over human cloning was rapidly circulating, and the subsequent discussion could not concentrate on the reasons and even differentiation of cloning against animal genetic engineering. Cloning has been done for a long time before the appearance of Dolly. The process of dividing or lysing embryos to make the same twins, separating the cells of a developing embryo into two, and transferring them to different recipient mothers were included in animal husbandry programs in the 1980s. Single twins are technically clones. Still, the term is now more commonly used to refer to an individual resulting from the transfer of cell nuclei of DNA from enucleated oocytes into a single somatic (non-egg) cell derived from an adult organism. In short, it has the shape of an egg that has its own DNA. This process is called somatic cell nuclear transfer (SCNT) cloning and has been successfully performed in many animal species (eg sheep, bovine and goat). From an animal breeding perspective, the importance of the SCNT procedure is that adult animals allow replication with superior performance characteristics.

Agricultural Uses

There are only a few possible uses for cloned animals in commercial farm operations. In the case of highly valued animals, they can provide a genetic insurance policy or produce several similar lines in production environments where artificial insemination is not an appropriate option. Theoretically, clones can also be used to amplify a genotype that is particularly suitable for a particular environment. The advantage of this approach is that a genotype that has been proven to be particularly good at a given location can be preserved indefinitely without genetic mixing that generally occurs in each generation with reproduction.However, the disadvantage of this approach is that at some point in time, it

freezes genetic progress towards desirable characteristics such as milk production or disease resistance. Since there is no genetic variability in a clone population, intra-herd selection no longer offers an opportunity for genetic development. Besides, the lack of genetic variability may make the herd or herd vulnerable to a catastrophic disease outbreak or individually tailored to changes in the environment.Although clones contain the same genetic information in their chromosomal DNA, they may be different; the identical twins do not look or behave in the same way. Clones do not share the same cytoplasmic inheritance of mitochondria from the donor egg or often the same pregnancy environment, because they are usually carried and multiplied by different animals. A recent study has shown that SCNT clones differ more than contemporary half-siblings (Lee et al. 2004).

Productivity and Problems

The cloning procedure is currently inefficient, with only 1% to 3% of the nucleated egg cells turning into live pups. A high rate of pregnancy loss was observed at various times after laying eggs containing adult cell nuclei in recipient animals. However, these problems are not universally observed in SCNT cloned cattle, and there are reports of apparently healthy cloned cattle that continue to conceive and have healthy calves (Lanza et al. 2001; Pace et al. 2002).

Abnormalities have also been observed in cloned animals after birth, these frequencies being at least partially dependent on the type of tissue from which the transferred nucleus is derived. These abnormalities include defects in the cardiovascular, musculoskeletal, and neurological systems, as well as susceptibility to infections and digestive disorders. Many of these problems appear to be due to the incorrect reprogramming of the transferred nuclear DNA, the shift from directing the cellular activities of a somatic cell to the complex developmental path needed for its full development. Researchers have documented abnormal gene expression patterns in cloned offspring and errors in both oppression and X chromosome inactivation (Thibault 2003).

Food Safety

The underlying food safety concern with SCNT clones is whether nuclear reprogramming during the cloning process has any effect on the composition of animal food products. There is no fundamental reason to suspect that SCNT-derived animals will produce new toxins or allergens. Studies comparing the performance of SCNT clones and other dairy cattle clones with their identical counterparts (siblings) showed no significant difference in performance or milk composition (Takahashi and Ito 2004; Norman and Walsh 2004; Walsh et al. 2003; Tome et al. 2004; Tian. et al., 2005).

The United States, Food and Drug Administration (FDA) Veterinary Center is developing a risk assessment to identify hazards from cloning and characterize food consumption risks (Rudenko et al. 2004). The reports on animal cloning show that the weight of the available evidence indicates that there is no biological cause based on fundamental scientific assumptions or empirical studies to indicate that edible products can be consumed from bovine, sheep, or goat clones. There is a higher risk of consuming these products from non-clone counterparts F (FDA 2003). Despite these findings, marketing of milk or meat from SCNT clones and offspring continues to be subject to a voluntary ban. F Additional data on the health status of the generation and the combination of clones and milk and meat from their descendants will serve to increase confidence in these results. Further, F the FDA report says. Many research groups are actively collecting such data.

Genetic Engineering

Although cloning is not genetic engineering, there is a logical connection between these two technologies. Genetic engineering involves altering the properties of organisms using recombinant DNA techniques to alter protein expression. A transgenic organism initially carries DNA derived from an organism other than its parent in its genomic DNA. Common examples of transgenic agricultural organisms are insect-resistant corn and cotton having insect microorganism and DNA, Bacillus thuringiensis (Bt) incorporated into its genome. To be able to pass on to new generations, this new transgenic DNA must be found in the germline cells (egg or sperm) of the organism. Microinjection of foreign DNA into newly fertilized eggs has been the dominant method for transgenic animal breeding in the last 20 years. This technology is inefficient (3% to 5% of born animals carry the transgene) and results in random integration of the target gene and variable expression levels in transgenic offspring.

Cloning increases the efficiency of genetic engineering by providing the opportunity to produce 100% transgenic offspring from cell lines known to contain the transgene. This expectation encouraged research that led to the development of SCNT cloning of animals, despite extensive media coverage of the highly controversial issue of human reproductive cloning. Cloning also provides a unique opportunity to produce animals from cells that have been subjected to precise and characterized modifications of the genome. The coding of the prion protein responsible for cow disease (bovine spongiform encephalopathy) or human xenotransplantation surgery (allergen proteins to which animal organs are transplanted to humans) involves the disruption of specific endogenous genes (Piedrahita and Mir 2004).

Agricultural Applications

Genetic engineering was initially envisaged to have many agricultural applications. Recombinant bovine somatotropin (BST), derived from genetically modified bacteria, is a genetic engineering product currently used in animal studies. This protein, which increases milk production in lactating cows, is widely used in the dairy industry of developed countries. Managing the RBST protein does not alter cow's DNA and is not genetically processed. The BST was approved in 1993 by the FDA after extensive testing by a large number of health associations and scientific communities that did not reveal health and safety concerns for consumers (Bauman 1999). Transgenic studies have been conducted not only on terrestrial animals but also on cultured freshwater or seafood. For example, he has requested the approval of the FDA to market a genetically modified seafood, a salmon that can grow four to six times faster than standard salmon grown under the same

conditions. However, it seems unlikely that genetic engineering will find widespread use to improve most livestock production characteristics. Agro-related properties, such as growth, tend to be controlled by many genes; this makes it difficult to select or predict how the expression of one or two recombinant proteins may affect these complex performance characteristics. Also, conventional selection techniques achieve steady and consistent genetic development rates for most animal species. They do not require the investment, risk, and time needed for the production and legal approvals of genetically modified organisms.Increasing the nutritional properties or safety of animal food products in ways that are not possible by conventional selection techniques, such as the production of hypoallergenic milk or low cholesterol eggs, is one of the future areas in which genetic engineering can provide unique opportunities.

Environmental and Ethical Concerns

It is stated that ecological problems are the biggest science-based problems faced by the animal biotechnology industry (NRC, 2002). The possibility that genetically modified organisms, especially fish and insects, can escape and worsen without being trapped is very worrying. The report also states that genetically engineered fish, especially those with increased fitness characteristics (eg, younger sexual maturity), can lead to ecological consequences (Muir and Howard 1999, 2001, 2002). The actual environmental risk caused by each species or transgene combination will depend on several factors, including retention strategies, species mobility, ability to be wild, genotype-environmental interactions, and stability of the recipient population. Similarly, food safety concerns with transgenic animals will likewise be case-specific, depending on the properties of the recombinant protein and whether it is a pharmaceutical, industrial, or food protein. There should be practices designed to identify and develop appropriate biotechnological management practices for animals, plants, and microorganisms, or that are genetically engineered with minimal physical and biological risks.

A genetically engineered animal, the red fluorescent zebrafish called GloFish, is commercially available in the United States. The FDA has decided not to regulate GloFish because tropical fish will not pose a threat to food and that there is no evidence that these genetically engineered zebra fish are a greater threat to the environment than their unchanged counterparts. Ethics committee experts generally said that it was not right to produce a genetically modified new organism “just a pet”.It reveals a unique aspect of genetic engineering concerning genetically engineered ornamental fish and has taken a special place in the animals that have in our society. However, there are two primary ethical concerns about genetic engineering of animals. The first is to overcome the barriers of species or "ethics accepted in terms of religious values." Proponents of this view show that life should not be viewed as a chemical product that is subject to genetic change only and can be patented for economic benefit. The second primary ethical concern is that the genetic engineering of animals interferes with the animal's integrity or "telos." Telos is defined as "a set of needs and interests that are genetically based and environmentally expressed and that this animal exhibits or is important to fulfill or prevent the animal or collectively define or define the way of life." Holland and Johnson, 1998).

Scientists can argue that science does not make value or moral judgment, and therefore ethical values are not scientifically relevant. The scientific process attaches great importance to controlled experiments as a way of gaining insight. Potential and perhaps fictitious concerns do not well coincide with a process that focuses on what can be measured, analyzed, and measured. The tendency to value what is subject to valid and experimental manipulation may conflict with the values of other groups in society. Given that it is challenging to integrate ethics with the scientific process, it is not surprising that scientists do not explicitly articulate the ethical problems that arise in their work.

2. Result

As a result of biotechnology studies, many genes have been identified for obtaining higher-quality meat, milk, and wool and for developing disease-resistant animals. Furthermore, techniques have been developed to make animals produce molecules of high medical value. However, by applying genetic engineering directly to animals, the way to create transgenic animals carrying genes with the desired properties is not yet clear. In addition to technical reasons, ethical and legal debates continue. Exemplary are Tilapia and Salmon species, which are genetically modified fish that grow faster and reach larger sizes. These fish, which are essential for African countries where protein needs are high, are produced in controlled farms.

Cloning is another essential gene engineering technique that is expected to be useful shortly in the livestock sector. In other words, it is a genetic copy. Thanks to this technique, farmers will be able to breed superior animals (which yield high-yield milk, high-quality meat) without the need for a fertilizing animal. However, this technology is not widely available for the time being due to the technical challenges that have yet to be resolved and the ethical debates of cloning. Although all these technologies are seen as an extension of traditional animal husbandry, which enables food production more efficiently, they have raised concerns about the deterioration of ecological balances. They have led to discussions involving many segments and institutions of society.

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