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ANIMAL CLONING BIOTECHNOLOGY (БІОТЕХНОЛОГІЯ КЛОНУВАННЯ ТВАРИН)

У даній публікації розглядається проблема необхідності клонування тварин у біотехнології, а також акцентується на важливості розвитку ефективних методів для виробництва повноцінних клонованих тварин. Досліджено наукові підходи та дослідження в галузі впливу клонування на генетичну ідентичність та властивості отриманих клонів.

***Ключові слова**: клонування тварин, перенесення ядер соматичних клітин, історія клонування, сурогатна мати, ідентичний близнюк, вівця Доллі.*

This publication addresses the necessity of animal cloning in biotechnology, emphasizing the importance of developing effective methods for producing fully cloned animals. Scientific approaches and research on the impact of cloning on the genetic identity and properties of obtained clones are explored. Specifically, the aspects of using somatic cell nuclear transfer (SCNT) and its application in breeding and restoring lost genetic traits in animals are discussed.

***Key words:** animal cloning, somatic cell nuclear transfer (scnt), history of cloning, surrogate mother, identical twin, dolly the sheep.*

Animal cloning stands as a groundbreaking reproductive method facilitating the creation of a genetically identical twin from an existing animal at a later stage. The initial approaches involved dividing embryos, but later advancements led to the development of somatic cell nuclear transfer (SCNT). Widely investigated in production animal agriculture, this distinctive reproductive technology is predominantly employed to recover lost genetics. Its utility in breeding is noteworthy, enabling producers to meticulously choose and reproduce specific genetic traits. Challenges, particularly the hindrance posed by low live birth rates, restrict the application of cloning in food animal production. Nevertheless, ongoing research is diligently addressing these hurdles, aiming to enhance the survival rates of clones. This concerted effort holds the promise of augmenting both the efficiency and economic feasibility of employing cloning technologies in animal agriculture [1].

History of cloning

Despite the recent strides that have sparked numerous discussions and opportunities in animal cloning, experiments in this realm have a history spanning over a century. The broad definition of an animal clone encompasses an animal originating from another, sharing identical chromosomal DNA. In the late 1800s, Hans Dreisch pioneered the creation of animal clones, specifically sea urchins, by splitting a two-cell embryo and allowing both cells to independently develop. These embryo-splitting endeavors persisted into the 1900s, notably championed by Nobel Prize winner Hans Spemman’s work on salamander embryos.

A pivotal moment occurred in 1952 when Robert Briggs successfully cloned a frog using a novel technique — nuclear transfer. This method involved transplanting the nucleus of a blastomere from a frog embryo into an enucleated egg. Despite Briggs showcasing that embryonic nuclear transfer could yield clones, skepticism prevailed regarding the use of adult somatic cells as donors. The turning point came in 1996 with the groundbreaking creation of Dolly, a cloned sheep. Dolly marked the first instance of cloning through somatic cell nuclear transfer (SCNT), using the nucleus of a differentiated adult cell as a donor. This watershed moment opened the floodgates to cloning various species in the subsequent decades [2].

The Possibility of Resurrecting an Extinct Animal

Utilizing somatic cell nuclear transfer (SCNT) for animal cloning emerges as a viable strategy for conserving endangered mammalian species. The potential lies in the retrieval of live cells from frozen bodies, facilitating the generation of cloned animals (Hoshino et al., 2009). Although the concept of “resurrecting” extinct species, like the woolly mammoth, from permafrost is often deemed impractical due to the absence of live cells, alternative avenues exist. Notably, it is established that "dead" sperm, subjected to freeze-drying treatments (Wakayama and Yanagimachi, 1998) or extracted from a fully frozen cadaver (Ogonuki et al., 2006), retain the complete haploid genome. Intriguingly, when such spermatozoa are injected into oocytes, the ensuing embryos can progress to full-term, giving rise to healthy offspring [3].

Cloning stands as the latest advancement in the progression of selective assisted breeding within animal husbandry. The process of cloning animals provides a dependable means of replicating exceptional livestock genetics, thereby guaranteeing the preservation of herds at the utmost quality. It is crucial to emphasize that cloning does not tamper with the inherent genetic composition or alter the DNA of animals; rather, it serves as an alternative method of assisted reproduction. By enabling livestock breeders to generate a precise genetic duplicate of an existing animal, essentially creating an identical twin, cloning facilitates the production of superior breeding animals instrumental in yielding healthier offspring.

Animal Cloning: During somatic cell nuclear transfer, researchers retrieve a cell from the animal intended for cloning, referred to as the "genetic donor." This somatic cell harbors the DNA specific to the genetic donor animal. Simultaneously, an egg is obtained from a female animal, serving as the "egg donor," and the nucleus of the egg cell, housing the egg donor's genes, is removed and discarded. Subsequently, the somatic cell is introduced into the egg. The resultant merged egg encompasses the DNA of the genetic donor. This fused egg is then implanted into a surrogate mother for further development. Following a full gestation period, the surrogate gives birth to an animal essentially mirroring the genetic donor, akin to an identical twin.

Animal cloning presents significant advantages for consumers, farmers, and endangered species:

- Cloning empowers farmers and ranchers to expedite the reproduction of their most high-performing livestock, enhancing the production of safe and nutritious food.
- The cloning process generates the healthiest animals, thereby reducing the reliance on antibiotics, growth hormones, and other chemicals.
- Consumers stand to gain from cloning as it ensures that meat and milk are not only more wholesome but also consistent and safe.
- The majority of cloned food products are derived from the progeny of clones, which are not clones themselves but rather the result of sexual reproduction.
- Cloning can serve as a safeguard for endangered species, exemplified by China's efforts to preserve panda cells for potential use in case the species faces the threat of extinction [4].

In conclusion, animal cloning technology stands at the intersection of historical achievements and contemporary challenges, representing both significant potential and serious difficulties. From historical experiments with sea urchins to modern advancements in agriculture and species conservation, animal cloning has emerged as a promising field with numerous applications. However, low survival rates and ethical concerns regarding its widespread use raise doubts about its scalability. Further scientific research and technological development are crucial to overcome these limitations. Moreover, the careful and balanced integration of cloning into agriculture and biodiversity conservation, considering ecological, ethical, and societal aspects, is essential to maximize its potential in addressing current challenges in these fields.

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