Cloning & Transgenesis

Kumar, Clon Transgen 2015, 4:2
DOI: 0.4172/2168-9849.1000e119

Editorial open access

Cloning: A Vital Tool for the Production Transgenics

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Rec date: June 15, 2015; **Acc date**: June 15, 2015; **Pub date**: June 18, 2015

Editorial

The aim of biotechnology is to understand the biochemical, cellular, and functional aspect of all the proteins encoded in the genome. Molecular cloning or recombinant DNA technology (RDT) is an important practice in research labs that is used to create copies of a particular gene for downstream applications, such as sequencing, mutagenesis, genotyping or heterologous expression of a protein. Heterologous expression is used to produce large amounts of a protein of interest for functional and biochemical analyses. It is a traditional technique frequently used to know about biochemical and functional aspect which involves the transfer of a DNA fragment of interest from one organism to other via a self-replicating genetic material plasmid. Cloned genes have been integrated randomly into the host genome for the production of transgenic organism (TO) or genetically modified organism (GMO). Any organism whose genetic material has been altered using RDT is known as TO/GMO. Recombinant DNA may contain DNA from the same or similar species (cisgenic or intragenic), or may contain DNA from different organisms that could not naturally interbreed (transgenic). Foreign DNA is introduced into the organism and then transmitted through the germ line so that every cell, including germ cells, of the organism contains the same modified genetic material. If the germ cell line is altered, characters will be passed on to succeeding generations in normal reproduction but if the somatic cell line alone is altered, only the organism itself will be affected, not its offspring. Cloning can also be achieved by nuclear transfer where the genetic material from one cell is placed into a recipient cell i.e. unfertilized egg and its genetic material is removed by the process enucleation [1].

A no. of foreign genes has been introduced into plants, animals and microbes. Bacteria were the first organisms to be modified in the lab, because of their simple genetics [2]. After that several GM plants and animals have been developed [3]. New plant varieties have been created using bacterial and viral genes that confer tolerance against disease and drought, high yielding varieties and allow plants to endure herbicides and pesticides. It also allows farmers to use less herbicide and water. Golden rice (a GM crop) provides high amount of vitamin A which was developed by International Rice Research Institute (IRRI), Philippine. DroughtGard maize developed by Monsanto became the first drought-resistant GM crop to receive US marketing approval. Modified Jatropha plant offers improved qualities of biofuel. A plant Enogen has been genetically modified to convert its starch to sugar for ethanol. GM plants and microbes have been used for bioremediation of contaminated soils and water bodies. Numerous transgenic mice, rat and fruit fly have been developed for studying various aspects of normal mammalian biology in research [4] Animals can be cloned by nuclear transfer for improving livestock to produce animals that are larger, more resistant to diseases, grow faster and more productive. Numerous mammalian species have been cloned from cells of preimplantation embryos of rabbits [5], pigs [6], monkeys [7], sheep [8], cattle and some endangered species [9].

Cloning may also be useful for the preservation of extinct and endangered species, production or food quality traits and in therapeutics where patients may be able to clone their own nuclei to make healthy tissue that could be used to replace diseased tissue without the risk of immunological rejection. Treatments are also being developed for a range of some incurable human diseases, such as cancer, cystic fibrosis, heart disease, sickle cell anemia, Parkinson's disease and muscular dystrophy [3]. Many valuable pharmaceutical products can now be made using transgenic animals such as mice, rabbits, sheep, goats, pigs and cows. Haemoglobin as a blood substitute human protein C, ATryn an anticoagulant, insulin for the treatment of diabetes, monoclonal antibodies as vaccines growth hormones for the treatment of deficiencies. A pig was engineered to produce fatty acid omega-3 through the expression of a roundworm gene [10]. Transgenic pigs also produced the phytase enzyme, which breaks down the indigestible phosphorus. The animal is able to digest cereal grain phosphorus with this enzyme. Chinese scientists Dr. Gray Richard developed genetically engineered transgenic cows with genes from human beings to produce milk that would be the same as human breast milk in 2011 [11]. This could potentially benefit those mothers who cannot produce breast milk. Jabed et al. [12] also developed a genetically engineered cow in New Zealand that produced allergy-free milk.

Cloning has great power for transgenics production and using frequently to cure diseases such as diabetes, cystic fibrosis, cancer. It revolutionized the genetics. Undoubtedly, the relationship between cloning and transgenics has travelled a long journey and both remain inseparable due to the outstanding capacity of organism to improve for serving the human, environment and economy. From above discussion it is clear that molecular cloning has been used as an effective weapon or tool for the production of valuable transgenic animals and plants for useful products. In conclusion, the cloning process has great promise for potential gains in biomedicine and agriculture. Judicious application of cloning can bring more benefits to mankind throughout the world. Further development of the cloning process will advance the commercialization of this technology for the benefit of society.

References

1. Briggs R, King TJ (1952) Transplantation of living nuclei from blastula cells into enucleated frogs' eggs. Proc Natl Acad Sci USA 39: 455-463.
2. Melo EO, Canavessi AM, Franco MM, Rumpf R (2007) Animal transgenesis: state of the art and applications. J Appl Genet 48: 47-61.
3. Lodish H, Berk A, Zipursky SL (2000) New York: W. H. Freeman.
4. Wakayama T, Yanagimachi R (1999) Cloning of male mice from adult tail-tip cells. Nat Genet 22: 127-128.

5. Chesne P, Adenot PG, Viglietta C, Baratte M, Boulanger L, et al. (2002) Cloned rabbits produced by nuclear transfer from adult somatic cells. Nature Biotechnology 20: 366-369.
6. Polejaeva IA, Chen SH, Vaught TD, Page RL, Mullins J, et al. (2000) Cloned pigs produced by nuclear transfer from adult somatic cells. Nature 407: 86-90.
7. Meng L, Ely JJ, Stouffer RL, Wolf DP (1997) Rhesus monkeys produced by nuclear transfer. Biol Reprod 57: 454-459.
8. Wilmut I, Schnieke AE, McWhir J, Kind AJ, Campbell KH (1997) Viable offspring derived from fetal and adult mammalian cells. Nature 385: 810-813.
9. Lanza RP, Cibelli JB, Diaz F, Moraes CT, Farin PW, et al. (2000) Cloning of an endangered species (Bos gaurus) using interspecies nuclear transfer. Cloning 2: 79-90.
10. Lai L, Kang JX, Li R, Wang j, Witt WT, et al. (2006) Generation of cloned transgenic pigs rich in omega-3 fatty acids. Nature Biotechnology 24: 435-436.
11. Gray Richard (2011) Genetically modified cows produce 'human' milk.
12. Jabed A, Wagner S, McCracken J, Wells DN, Laible G (2012) Targeted microRNA expression in dairy cattle directs production of -lactoglobulin-free, high-casein milk". Proceedings of the National Academy of Sciences 109: 16811-16816.